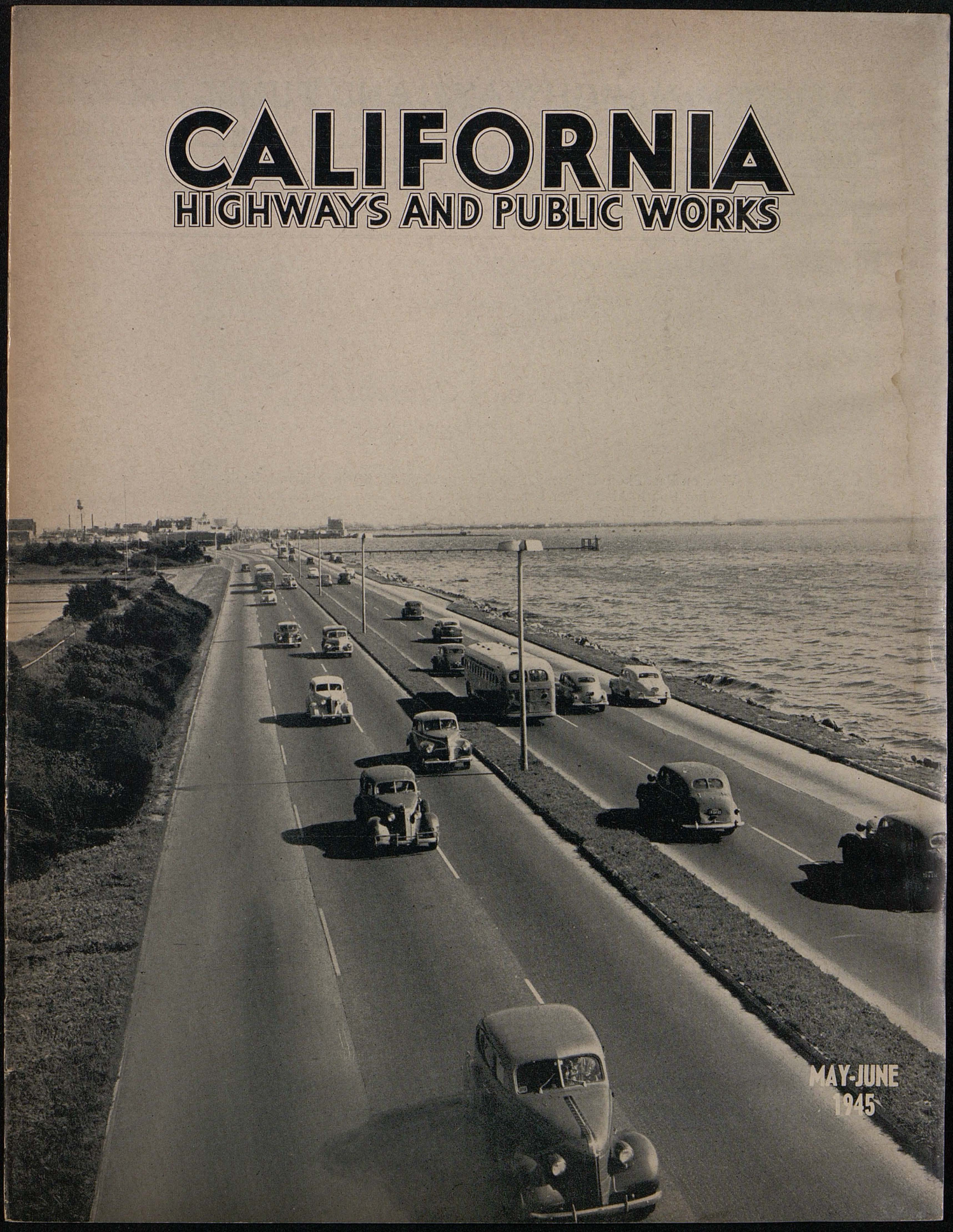
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



MAY-JUNE
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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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New Traffic Counting Procedure for Commercial Vehicles Inaugurated

By CHARLES V. GAY, Associate Statistician

FOR a number of years the Division of Highways has been concerned with the weight of commercial trucks and combinations. This interest has not been confined to those relatively few vehicles which exceed legal limitations as to total weight or weight on a specific axle, but has been extended to all commercial vehicles, large and small, which constitute the commercial burden imposed on the Highway System. The trend in frequency of occurrence of vehicles or combinations of vehicles of certain types, as well as the trend in the average gross weight of vehicles of each type, has a direct bearing on the loads imposed upon the highway and consequently upon the proper highway design required to support these loads.

Equalizing beam and loadometers in place in concrete loadometer pit

In 1936 the Highway Planning Survey undertook a program of truck weighing on a regular schedule for a period of one year. Under this program weights were obtained for 151,593 commercial vehicles at seven pit-scales and at 90 loadometer stations well distributed over the Highway System to produce representative coverage. With this large amount of data available, no further weighings were made until the fall of 1942, at which time a limited program was undertaken at ten representative locations all of which coincided with locations weighed in original 1936 survey.

This limited survey was repeated in the fall of 1943 and again in the fall of 1944 with the coverage increased to 19 locations. In addition to weights obtained for 5,022 commercial vehicles on the rural highways in the past three years, the scale facilities of San Francisco-Oakland Bay Bridge and Carquinez Bridge were utilized to obtain weights on some 11,000 vehicles between December, 1944, and March, 1945.

Comparison of the 1944 weighings with those obtained in 1936 indicates an increase in the average weight of all trucks and combinations from 11,556 to 19,281 pounds, or 66.8 per cent as shown in Table I.

The large increase in the weights of commercial vehicles between 1936 and 1944 was due in part to the relatively greater proportion of heavier type vehicles with multiple axles using the highways and in part to generally heavier loadings, particularly with respect to vehicles which formerly operated empty or lightly loaded in one direction, but which, as a result of increased activities due to the war and pressure on transportation facilities, were able to operate loaded for a greater proportion of their total mileage.

TABLE I

Comparison of Average Weight of Trucks, 1944 vs 1936

Vehicle Classification	Year Weighed 1944	Year Weighed 1936	Per cent increase over the period
Empty trucks and combinations	9,372	7,225	34.7%
Loaded trucks and combinations	23,470	13,779	70.3
All trucks and combinations	19,281	11,556	66.8
Average maximum axle load of loaded trucks and combinations	11,995	6,622	81.1

STABILITY OF WEIGHTS

Careful analysis of the weights of commercial vehicles from the foregoing sources, when broken down by vehicle type, indicates that for any given type the average weight of all vehicles encountered on the highway, including fully loaded, partially loaded, and empty vehicles of the type, tends to become stabilized within a comparatively small sample and, further, that this stabilized average weight will generally hold within a reasonably small range irrespective of the geographic location of the vehicles. Vehicle types are classified on the basis of axle arrangement. Thus, a two-axle truck is classified as Type 2, a two-axle truck pulling a two-axle trailer is classified as Type 2-2, and a two-axle tractor-truck pulling a two-axle semi-trailer is classified as Type 2s2, etc. A type 2s2 pulling a three-axle trailer is classified as Type 2s2-3.

This relative stability of average weights is brought out by the data in Table II, which shows the average weights of several of the more frequently encountered vehicle types as obtained from loadometer weighings made at widely scattered locations over the State and from the Carquinez and San Francisco-Oakland Bay Bridge weighings.

GROUP AVERAGE

The comparison of the average weight of all vehicle types supported by the same number of axles irrespective of the arrangement of the axles is shown in Table III. It will be noted that while certain types within a group may vary considerably from the group average, they are, as a rule, types which are seldom encountered and thus have but slight effect on the group average. In fact, each group average is largely controlled by one or possibly two predominant vehicle types. Thus, in the group supported by three axles, the average weight of Type 2-1 vehicles is but approximately half of the group average. However, this type of vehicle represents but 0.40 per cent of all commercial vehicles weighed and the group is dominated by Type 3 and Type 2s1 vehicles, which represent 11.33 per cent of all commercial vehicles weighed.

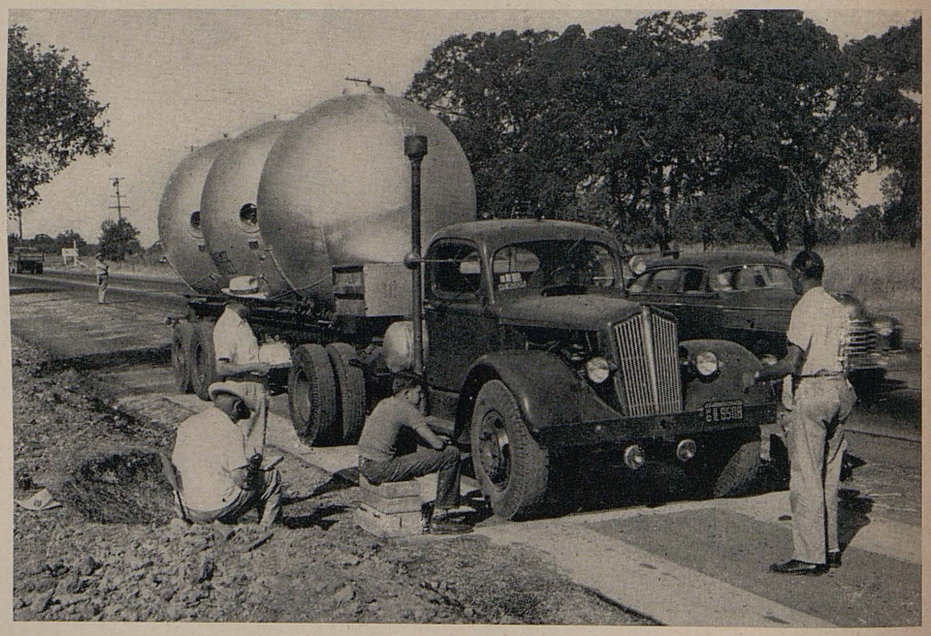
A study of the data presented in Table III leads to the conclusion that it would be possible to determine the average and total weight of commercial vehicles passing over a specific highway location with a reasonable degree of accuracy by merely making a traffic count of such vehicles, classified according to the number of supporting axles, and converting this count to total weight of traffic for the period counted by expanding the number of vehicles in each classification by the average weight applicable thereto. The average weights used as expansion factors would, of course, be revised from time to time as the results of actual weighings indicate changes in vehicle design and loading practices.

Weighing third axle of type 2s2 gasoline transport combination

PROCEDURE REVISED

It has been our practice for a number of years to classify commercial vehicles as light trucks, heavy trucks, and trailers. Under this procedure there was no clear-cut line of demarcation between what constituted a light truck or a heavy truck, this being left to the judgment of each enumerator. Further, trailers were counted separately from the trucks which pulled them, but semitrailers were not counted at all, being included in the heavy

Weighing first axle of type 2s2 butane gas transport combination



truck classification. This treatment did not readily lend itself to conversion to a weight basis. Consequently, our traffic counting procedure is being revised by eliminating certain vehicle classifications and substituting therefor a classification based on the number of supporting axles, as follows:

Classifications Eliminated
- Light trucks
- Heavy trucks
- Truck trailers
- Trailer coaches
- Other passenger car trailers

New Classifications
- Pickups
- Two-axle trucks
- Three-axle trucks
- Four-axle trucks
- Five-axle trucks
- Six-or-more-axle trucks

In order to keep the number of traffic classifications within practicable limits it was necessary to eliminate the Trailer Coach and Other Passenger Car Trailer classification. However, these vehicle types have not attained the importance in the traffic picture that their use at one time indicated might occur and it is believed the loss of this information will be more than offset by the gain to be obtained through the use of the new truck classifications. It will be noted that a new classification, Pickups, has been added to the commercial grouping. This classification has been provided to cover light commercial vehicles weighing not over 3,000 pounds when unladen and licensed as passenger cars. Such vehicles have not been included in our weighing activities and consequently are not reflected in the average weight of two-axle trucks.

Grant P. Merrill Honored

ASSOCIATED with highway promotion, construction and maintenance for 35 years, Mr. Grant P. Merrill, Highway Maintenance Superintendent of District IX, has resigned. He has been employed by the Division of Highways since August 15, 1912 and was highway maintenance superintendent at Mojave since September 1, 1933, transferring there from District X.

On the evening of May 29, associates and friends of Mr. Merrill gathered at Reno's Cafe in Mojave to tender Mr. Merrill and Mrs. Merrill a testimonial dinner. Highway Foreman M. M. Warner was master of ceremonies. The affair was attended by District Engineer S. W. Lowden of District IX and his staff.

TABLE II

Average Weight of Certain Types of Commercial Vehicles as Obtained From Various Sources

	Source of Data	Type 2 Number Weighed	Type 2 Average Weight	Type 2s1 Number Weighed	Type 2s1 Average Weight	Type 3 Number Weighed	Type 3 Average Weight	Type 3-3 Number Weighed	Type 3-3 Average Weight
1942-3-4	Loadometer Surveys	2,710	9,842	236	21,960	235	21,233	442	50,893
1944-5	Carquinez Bridge	2,063	8,775	208	24,212	226	20,140	518	51,014
1944-5	S.F.-Oakland Bridge	5,233	9,056	602	21,843	369	20,744	141	45,778
	All Sources	10,006	9,216	1,046	22,361	830	20,715	1,101	50,295

TABLE III

Frequency Distribution and Average Weight of Commercial Vehicles Classified by Number of Supporting Axles

Type of Vehicle	Number Weighed	Per cent of Total	Average Weight Pounds
Two-axle Vehicles			
2	10,006	60.41	9,216
Three-axle Vehicles			
2-1	67	.40	11,113
2s1	1,046	6.32	22,361
3	830	5.01	20,715
Group Total	1,943	11.73	21,281
Four-axle Vehicles			
2-2	192	1.16	28,364
2s1-1	2	.01	44,600
2s2	1,516	9.15	30,670
3-1	5	.03	33,920
3s1	21	.13	29,347
Group Total	1,736	10.48	30,424
Five-axle Vehicles			
2-3	51	.31	38,327
2s1-2	253	1.53	45,846
2s2-1	5	.03	44,840
2s3	7	.04	36,686
3-2	206	1.24	40,726
3s2	958	5.79	44,515
Group Total	1,480	8.94	43,966
Six-or-more-axle Vehicles			
2s1-3	20	.12	54,450
2s2-2	133	.80	43,163
3-3	1,101	6.65	50,295
3s1-2	9	.05	55,910
3s2-1	3	.02	58,333
3s3	113	.68	50,769
2s2-3	12	.07	43,950
2s3-2	1	.01	38,900
3s2-2	5	.03	60,120
3s2-3	1	.01	58,300
Group Total	1,398	8.44	49,745
Total	16,563	100.00	19,377

Bridge Maintenance Practice On California Highway System

By R. J. ISRAEL, Associate Bridge Engineer

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $12,500,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenanceand Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the fourth. It deals with Repair of Steel Trusses.

STEEL truss bridges comprise in number only 4.5 per cent of all structures on the California State Highway System, excluding the State-owned toll bridges. However, numbers alone do not indicate the relative importance of the steel trusses since the great majority of the long spanned structures, and most of the movable bridges on the system, are of this type. The roadway area of the steel truss bridges, including only the steel truss portion of composite structures and not including approach spans of other types, comprises 11 per cent of the total bridge area. The value of the steel truss structures represents approximately 20 per cent of the total value of all State Highway bridges.

Steel structures, when properly maintained, show virtually no deterioration with time. Due to this cause and to the fact that structures of this type are generally costly to replace, the elimination of the old and inadequate steel trusses has not kept pace with the replacement of obsolete structures of other types. This condition is best demonstrated by the fact that 29 per cent of all State Highway bridges which are posted for less than legal loads are steel truss structures. The above figures show that in spite of the relatively small number of such bridges, steel trusses represent a sizable maintenance problem.

Maintenance and repair as it applies to steel structures may be divided in three classes as follows:

1. **Normal and continued maintenance as necessary to preserve the structure.**
2. **Repair of accidental damage.**
3. **Strengthening, and improving clearances.**

NORMAL MAINTENANCE

By far the heaviest and most costly maintenance item on steel truss bridges is painting. In the coastal regions of the State particularly, steel structures must be painted at frequent intervals in order to prevent actual reduction in area of members due to corrosion. Structures directly adjacent to the ocean should be cleaned and repainted every four or five years, while for those structures located some miles inland, such as the Redwood Highway or the easterly shores of San Francisco Bay, the painting interval will be 7 to 10 years. On the other hand, in the Central Valleys and other dry areas of the State, the painting of steel is primarily for appearance. In these areas steel trusses may be allowed to go unpainted for a great number of years without measurable loss of metal.

Another important item of constant maintenance is the clearing of earth, leaves, and other debris from trusses and truss shoes. In forested areas particularly, leaves will accumulate in the truss joints and within the boxed lower chords of riveted trusses. If allowed to remain they retain moisture, thus hastening the deterioration of the paint covering and, in time, causing pitting or corrosion of the steel. The accumulation of debris around the expansion rollers on the truss piers not only causes rust and corrosion but the heavier materials may actually jam or otherwise interfere with the action of rockers or roller nests.

REPAIR OF DAMAGE

Damage to truss bridges of the through and pony truss type is caused primarily by highway traffic. More specifically, overheight or overhanging loads, and improper or careless operation of vehicles are responsible for such damage in the majority of cases. Floods cause considerable damage to bridges of all types, both through underscour of the foundations, and through the impact of heavy objects carried by the flood waters. The lower chords and bracing of deck

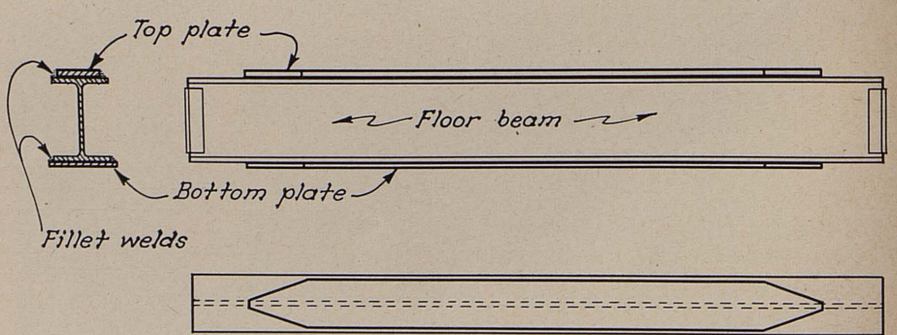
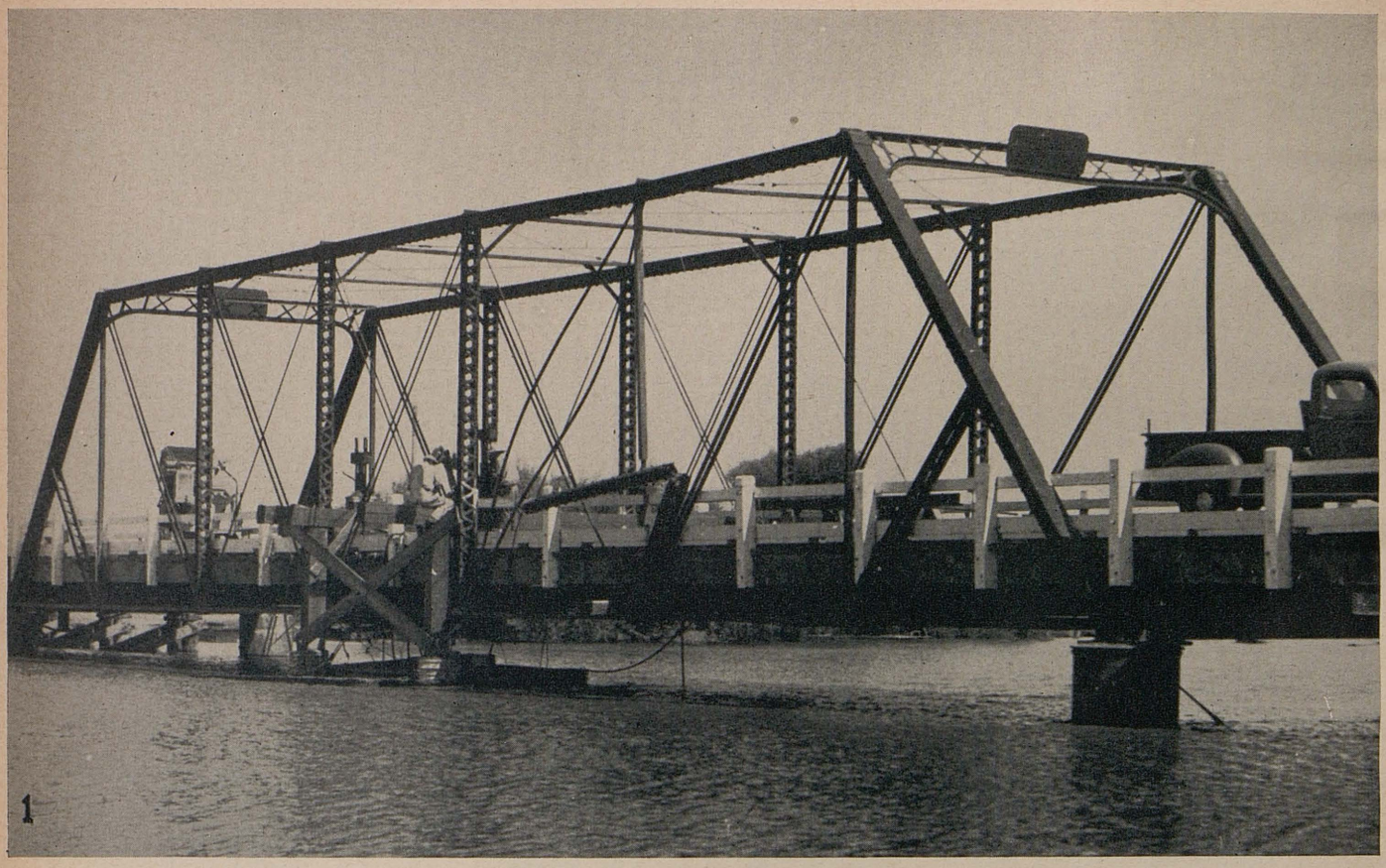


PLATE METHOD OF STRENGTHENING FLOOR BEAMS



Repair of traffic damage at Kings Slough Bridge. Truss has been jacked back to grade through C. M. P. caissons and temporary supports placed under top chord. The broken vertical posts, bent almost double, shown in the center foreground

trusses are particularly susceptible to this latter type of injury in those locations where clearances are insufficient under flood conditions. Fire has been a minor cause of damage to steel trusses since bridge steel is of low carbon content and not readily damaged by heating.

In the past decade five steel trusses and two combination steel and timber trusses have been so severely damaged by highway loads as to cause complete collapse of the structure. In each such instance trusses were of the pin-connected type, generally of light design, and lacking adequate lateral bracing. In every case structure and structural members were so badly racked, bent or broken that restoration of the truss was not economically feasible.

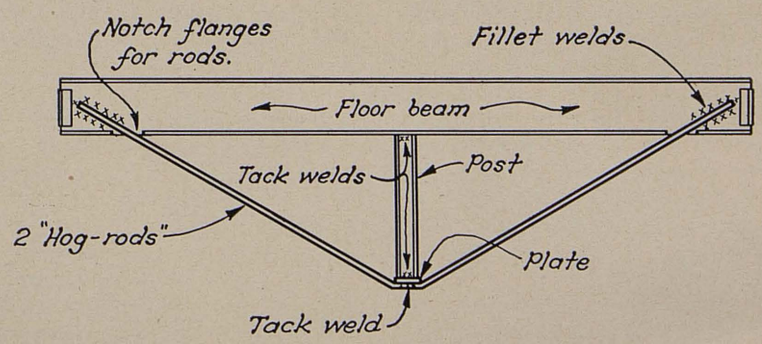
EXAMPLES OF BRIDGE DAMAGE

On the other hand, a great number of truss bridges have been struck and vital members broken or otherwise rendered ineffective without causing failure of the truss. Riveted type structures, due to stiffer lateral bracing and more rigid connections, have in every instance proved able to survive such damage. More difficult to explain is the fact that a number of pin-connected trusses, old and of light design, have remained standing even though primary members were either broken or otherwise rendered virtually incapable of supporting load.

A light steel truss of 154 feet span, built by San Luis Obispo County in 1910 is in this latter class. A runaway trailer crashed into and wedged between the two end posts at the south end of the structure, partially fracturing and badly bending both of these primary compression members without causing failure of the span. Repairs consisted of temporarily bolting supporting timbers to the two damaged posts and later placing falsework under the three adjacent panel points and replacing the posts in kind.

KING'S SLOUGH BRIDGE

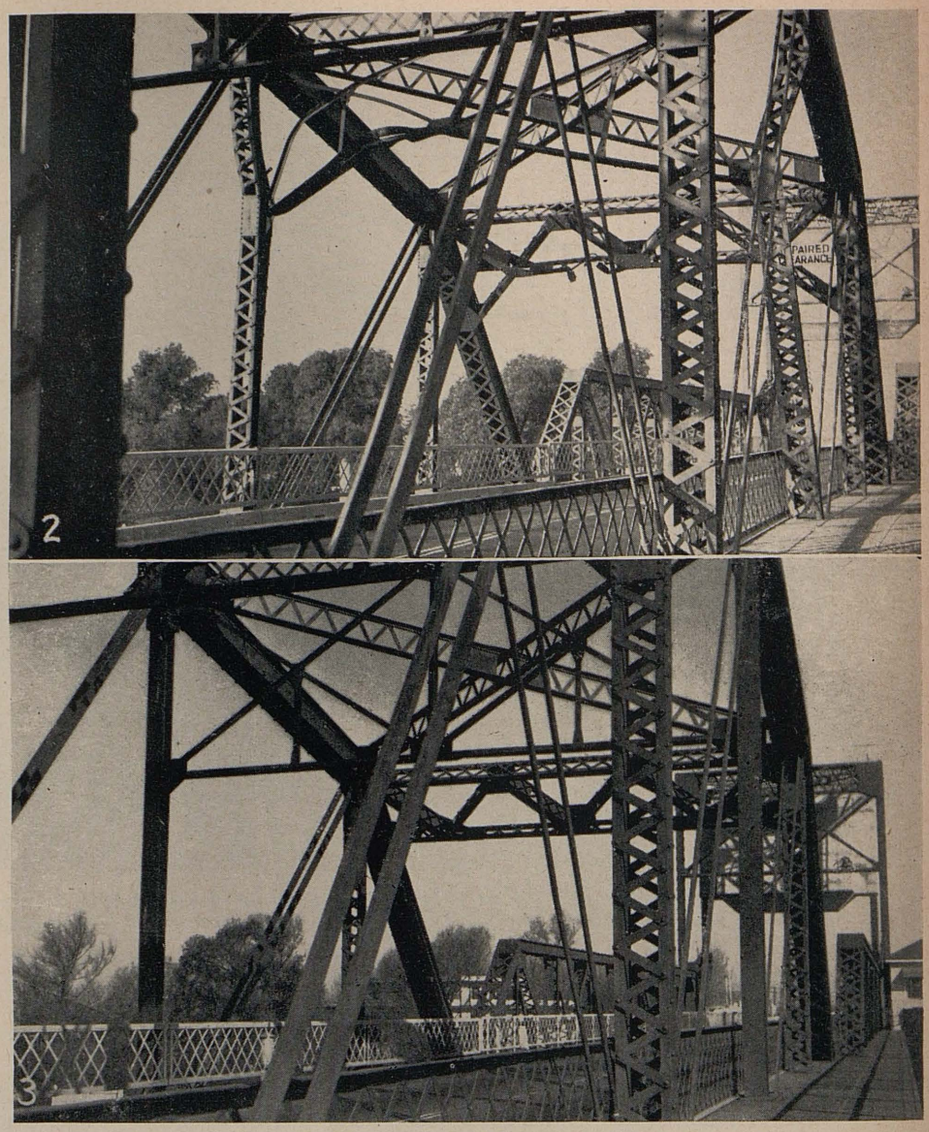
The main span of the King's Slough Bridge on State Route 41 consists of a 120-foot through truss, originally con-



TRUSS BEAM METHOD OF STRENGTHENING FLOOR BEAMS

structed in 1896. This is an extremely light, pin-connected structure, probably of wrought iron, and posted for restricted loading. A weaving trailer hooked into and completely severed the vertical post of the northerly truss at the second panel point, causing severe twisting of the adjacent floorbeam, damage to the top chord joint and to lateral members, and considerable warping of the trusses. The structure not only sustained itself in this condition but two trucks and several automobiles crossed the bridge before barricades could be placed.

In order to restore the structure to proper grade, two caissons were constructed by welding steel plates to one end of 24-inch x 20-foot long corrugated metal pipes. These caissons which were sunk in 18 feet of water and filled with concrete were placed outside and adjacent to the third and fourth panel points of the north truss. Timber beams, one end supported on the caissons and the other on the curb of the sound southerly truss, were placed to support the jacks. Jacking was accomplished through a yoke between the floor beams adjacent to the damaged truss and U-bolts which extended through the deck. The broken vertical member was replaced with a 12-inch I-beam, prefabricated to fit existing connections. The twisted floorbeam was straightened and tears in floor beam web and at connections were repaired by field welding. **Photo No. 1** shows this structure after it had been jacked back to grade and the upper chord strutted, but before the broken vertical was replaced.



Before and after pictures of traffic damage repair on the Mossdale Bridge. Figure 3 shows the damaged posts replaced with H beams

REPAIR METHODS

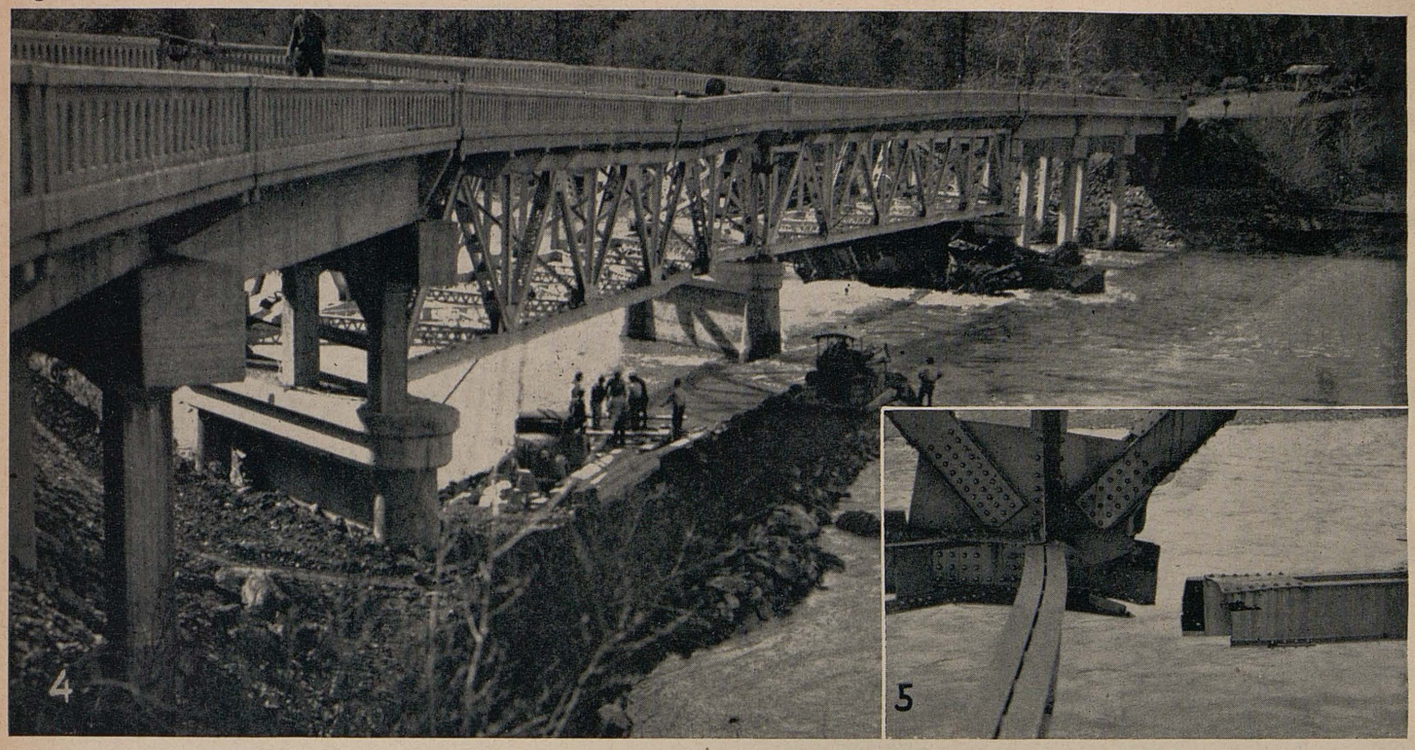
Normally, when a truss is seriously damaged as above, the first step in repair is to place temporary supports under the adjacent panel points to relieve the weakened member and generally reduce stresses throughout the truss. Occasionally the height of the truss or poor foundation conditions make sure method of support impracticable, as at the Mossdale Bridge over the San Joaquin River. Here a load of illegal height struck the east portal frame, severing two steel angles, and continued through to strike the first intermediate sway frame.

All members of this frame were bent and twisted out of shape and the two adjacent major compression members of the truss were pulled and twisted out of position some two feet inward and nine inches in the direction of traffic. Although this 200-foot truss span could no longer act as designed, it continued to carry all traffic for some time before the condition was reported. In this case the temporary supports were steel H-beams jacked between the truss chords alongside the damaged posts. The repair consisted of replacing the damaged posts with 10-inch H-beams, the use of rolled beams rather than an attempt to match the laced channel compression members being standard procedure. However, in this case, instead of trying to fit existing connections at the chords, the damaged posts were merely cut away between the end batten plates, the stubs capped with steel plates, and lengths of H-beam welded between. The damaged sway frames were replaced with new members welded into place. The damaged truss and the completed repair are shown respectively in **Photos 2 and 3.**

TRINITY RIVER BRIDGE

Probably the most spectacular instance of damage to trusses from floating objects occurred at the Trinity River Bridge on Route 20 in the winter of 1940. A dredger barge, torn loose from its moorings by the flood waters, was first driven against the lower chord of the southerly truss span and then forced around against the adjacent northerly truss.

The upstream lower chord of the south truss was completely severed and both lower chords were bowed out of line. A majority of the lower lateral struts in both trusses were broken, and a great number of main and bracing



The damaged Trinity River Bridge with temporary repairs under way. Inset shows the severed lower chord

members, and gusset plate connections, were badly bent and twisted. These were riveted deck trusses of modern design, 125 feet span, and the stiffness of the joints, coupled with the remaining lateral stability of the unbroken bracing were sufficient to prevent complete failure. The south truss was temporarily supported on timber cribs and a contract was let to replace the worst damaged members, and to straighten those that could be salvaged. **Photo No. 4** shows the damaged structure with temporary repairs under way and **Photo No. 5** is a closeup of the severed chord.

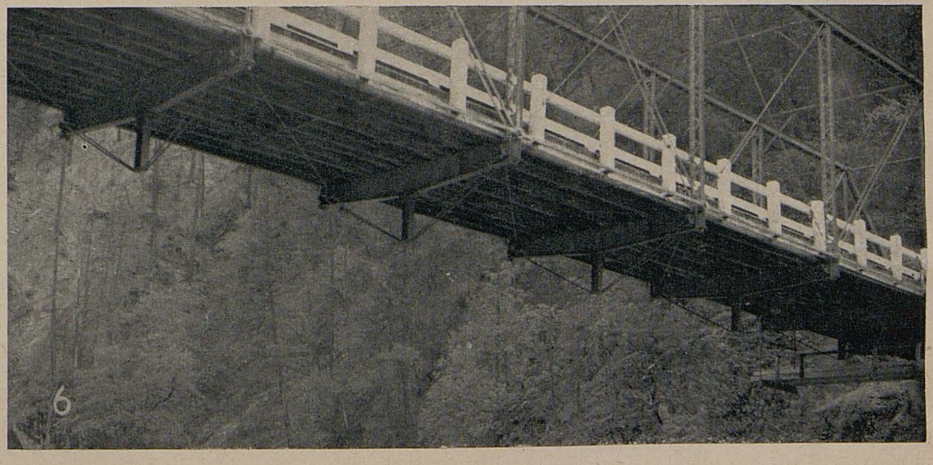
A vehicle will often hook onto the inside bar of a tension diagonal, leaving a permanent bend in the member and causing the other bar to take all the stress. A method which has been used extensively for straightening plates in the shipbuilding industry has been used recently to successfully correct this condition. This method consists of applying controlled fast heat to a short, V-shaped segment of the bar. As this short section expands it is compressed between the colder adjacent portions of the member, local upsetting occurs and is maintained by rapid quenching. This method is repeated at several points along the convex side of the bend until the bar is straightened. A "come-along" attached to the bar and applying pressure in the required direction aids the process. Although a bar thus straightened will, of course, be unstressed under dead load, it is able to assume its share in supporting live load.

STRENGTHENING

There are a great number of lightly designed steel trusses on California highways, the majority of which were inherited by the State through extensions of the Highway System. Due to the relatively high cost of steel truss replacements, the elimination from the system of all inadequate structures of this type will require many years. For this reason the strengthening and improving of existing steel trusses is of primary importance in eliminating undue restrictions to traffic.

The deck system on the older trusses is often inadequate for present day highway loads, and such members have been strengthened in a great number of bridges, particularly when trusses themselves proved adequate. Additional stringers may be added, between existing lines, to bring stringer capacity up to legal requirements, or, where the deficiency is small, a higher

Floor beams of a through truss bridge strengthened by the truss beam method



type floor may provide the proper strengthening by better distributing the wheel loads to existing stringers.

Floorbeams are, in most instances, the critical member from the standpoint of load capacity, and extensive work has been done in the strengthening of floorbeams on the lighter trusses. The most common method is to increase the capacity of the existing beam by welding steel plates to the top and bottom flanges. This work can be most easily accomplished in conjunction with replacement of the deck system, since dead load is thus removed and the top flange is made accessible. A variation of the method, when deck is not replaced, is to weld two bars to the under side of the upper flange in place of the single plate on top. Installation is more difficult and costs necessarily higher under this latter method.

TRUSSED BEAM METHOD

The trussed beam method of strengthening floorbeams is often used where clearances and drift conditions permit. This method consists in converting the floorbeam into an inverted king post truss by means of a vertical post and one or more bent steel rods, commonly known as "hog-rods." Generally, under this method, dead load is supported by beam action and live load is taken by the truss. However, where conditions permit jacking from below, the dead load stress in the beam may be relieved before the rods are welded into place. The two primary methods of strengthening floorbeams are illustrated in this article and **Photo No. 6** shows the use of the trussed beam method to reinforce floorbeams on a steel truss span.

Where a few truss members reduce the capacity of the structure far below that of the balance of the truss, such members can be replaced or reinforced. However, when a large percentage of truss members are below standard, such methods are seldom economically feasible, as such structures are usually also inadequate in width, lateral stability and other features.

The 90-foot riveted, deck truss over the Mad River on Route 35 in Trinity County proved an exception. Although the structure was of light design, it was otherwise adequate for the small amount of traffic on this secondary highway. In this instance, the truss span was shortened one panel at each end by placing inclined bents to supports at the base of existing abutments. In addition, a number of truss members were strengthened by welding additional angles or rods to these members and reinforcing the existing riveted joints with fillet welds.

Improvement of vertical clearance by replacement of main trunion braces on the Petaluma Creek Bridge

MOVING TRUSSES

Although under normal conditions the moving and re-erecting of a salvaged steel truss is not economically justified, the present shortages in structural materials have necessitated such procedure in a few instances. Where a light truss is thus reused, the shortening of the span by eliminating one or two center panels will increase the capacity of virtually all truss members and generally add to rigidity and lateral stability.

Truss bridges as a general rule are very difficult to widen. On through and pony truss structures, the spacing between the trusses is the limiting factor as truss capacity is generally insufficient to warrant complete replacement of lateral members. Capacity to support the increased live and dead loads is generally the limiting factor in deck trusses. However, roadway widths are often effectively increased by other means. Where pedestrian

(Continued on page 23)

Report on Progress and Records in Pavement Construction During 1944

By EARL WITHYCOMBE, Assistant Construction Engineer

DURING the year 1944, out of a total of about 600 miles of highway construction, but 35.2 miles of high type pavement, portland cement and asphalt concrete, were constructed, this being the second lowest mileage during the past twenty-year period. During the war emergency, high type pavements have been held to the absolute minimum, since these types require a maximum of manpower and equipment.

In conformance with current Federal regulations, no reconstruction of existing highways was done, other than essential access projects which were sponsored by the Federal Government, and for which the State acted as the construction agency. About 159.2 miles of such access roads were constructed during the year, 26.5 miles being high type pavements, and 132.7 miles low type bituminous surfaces.

Highways improved with State funds were practically all surfaced with bituminous blankets applied to existing pavements which had deteriorated due to heavy traffic during the war emergency. A total of 439.4 miles of such repair surfacing was done, about 3.4 per cent of the entire rural State Highway System. It is doubtful if the State System can continue to serve traffic requirements satisfactorily for very long under such a limited improvement program. The necessity of reconstruction and replacement is fast approaching the critical stage.

The quality of work obtained under this greatly curtailed program was somewhat inferior to that of prewar pavement construction; however, it maintained the average quality of all work done since the start of the war.

Portland Cement Concrete

The limited pavement program of 1944 was constructed with the same general design as was adopted in 1942 for war work. Based on the results of experimental paving sections constructed in many of the older jobs, a radical departure from prewar design is now being planned for postwar construction.

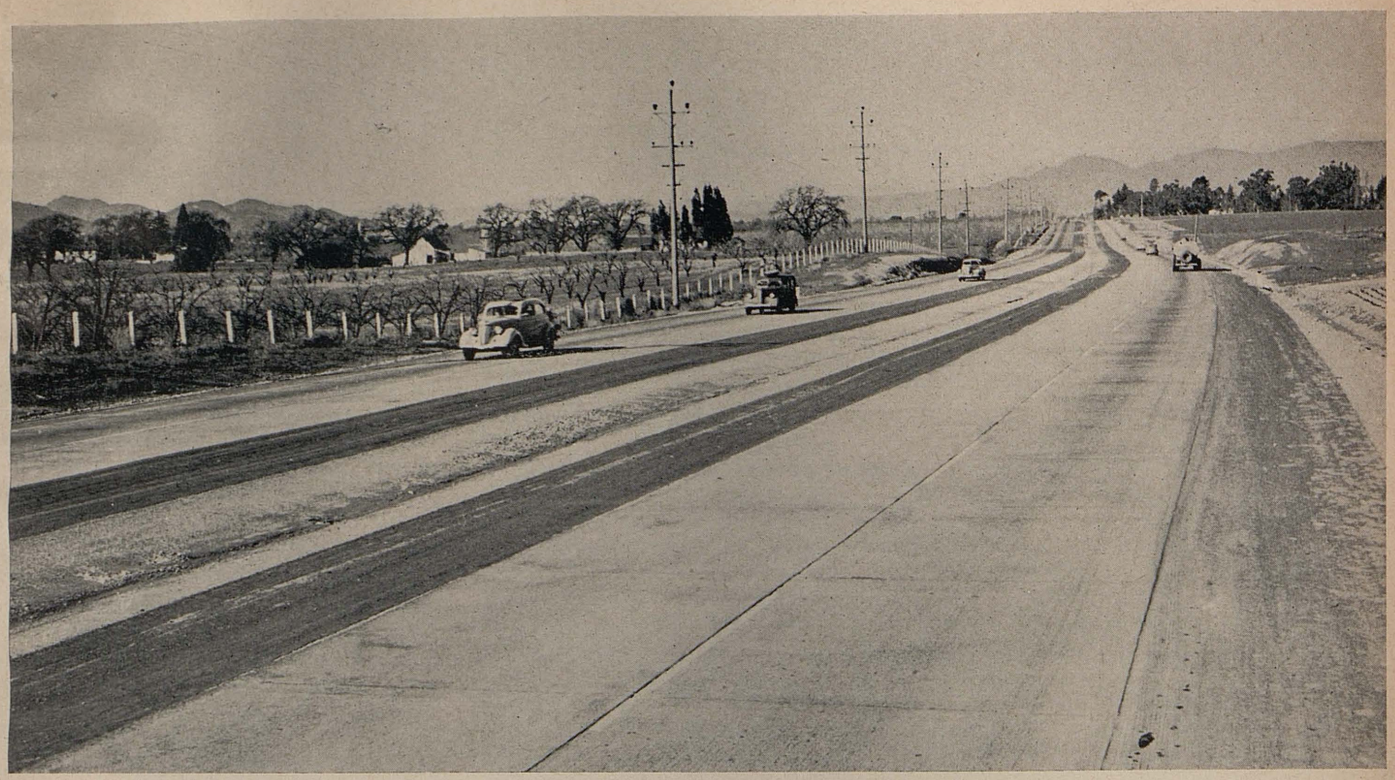
An extensive study is at present in progress under the supervision of the Materials and Research Department, covering existing portland cement concrete pavements, with the object of gathering information on the influence of mixture design and subgrade characteristics in relation to the performance of concrete pavements. It is hoped that facts uncovered in this survey may be of material value in improving the design of future pavements.

The highest **average daily output** of portland cement concrete during 1944 was made by J. A. Casson Co. & N. M. Ball Sons, on Contract 10AWC1, road X-Sol.-Nap.-74-B, A, B, North City limits, Vallejo to Suscol Creek, where an average of 609.1 cu. yds. per 8-hour day was placed. G. R. Hubbard was resident engineer, with E. Carlstad as street assistant. The average daily output for the entire State was 425.8 cu. yds. in 1944, compared to 354.9 cu. yds. in 1943.

The highest **average compressive strength** during 1944 was made on Contract 11AXC1, road XI-S.D-199-A, Palm Avenue to the Silver Strand, with 4221 pounds per square inch. Griffith Company was the contractor; H. F. Caton, resident engineer; and

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1944

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per day	Average strength, 28 days, lbs. per sq. inch	Roughness index, inches per mile
At Hunter's Point, Donahue St., Jerrold and Kirkwood Avenues	Eaton & Smith	C. T. Ledden	E. W. Strandberg	83.0	4016	27.3
Sequoyah Road, Oak Knoll Blvd.-San Leandro Naval Hospital	Heafey-Moore Co.	L. G. Marshall	L. G. Marshall	119.4	3462	22.1
At Atlantic and Bandini Blvds.	Vido Kovacerich	R. M. Cooley	R. M. Cooley	117.4	3552	7.5
Douglas St., Imperial Highway-1400 ft. South	Olympic Contracting Co.	G. H. Lamb	G. H. Lamb	236.1	3535	11.3
Sepulveda Blvd.-Valjean Ave.	Griffith Company	C. P. Montgomery	V. O. Sheff	293.0	4190	16.0
N. City Limits Vallejo-Suscol Creek	J. A. Casson Co. & N. M. Ball Sons	G. R. Hubbard	E. Carlstad	609.1	4030	9.5
Third Street, Napa-Suscol Creek	J. A. Casson Co. & N. M. Ball Sons	G. R. Hubbard	E. Carlstad	485.9	3470	8.5
Palm Avenue-The Silver Strand	Griffith Company	H. F. Caton	G. L. Richardson	373.5	4221	10.3
Mission Valley Road-Linda Vista Housing Project	Griffith Company	R. C. Payne	B. F. Moore	227.7	2968	9.5
			Averages	425.8	3876	10.3



Portland cement concrete pavement north of Vallejo on new 8.9 mile access road project

G. L. Richardson, street assistant. The average strength of 28-day breaks for the State was 3876 pounds, compared to 3570 pounds for 1943.

The record for **riding qualities** was made on Contract 7AXC2, VII-L.A-167-A, at Atlantic and Bandini Boulevards, with an average roughness index of 7.4 inches per mile. Vido Kovacevich was the contractor; R. M. Cooley, resident engineer and street inspector. The average for the State in 1944 was 10.1 inches, compared to 14.2 inches in 1943.

Asphalt Concrete

All of the work constructed this year was laid with the type of spreader machine that operates without the

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1944

Location	Contractor	Resident Engineer	Street Assistant	Average tons laid per day	Average stability of surf. mix in %	Roughness index, inches per mile
Hunter's Point Blvd., Innes Ave., Donahue Street	Fay Improvement Co.	G. L. Beckwith	J. H. Creed	168.5	42.0	16.8
0.3 mi. S. of San Leandro-N. City Limit of San Leandro	Lee J. Immel	F. W. Montell	G. W. Levier	491.4	37.6	18.0
Barrett Ave.-Pennsylvania Ave.	Macco Construction Co.	W. A. Rice	D. N. Sapp	272.1	41.0	44.4
Waldo-Golden Gate Bridge	A. G. Raisch	H. A. Simard	C. Hendrickson	373.0	44.0	15.0
San Francisco-Oakland Bay Bridge-Toll Plaza	Lowrie Paving Co.	H. A. Simard	C. Hendrickson	421.9	41.5	14.0
Gilman Street Intersection and Approaches	Lee J. Immel	F. W. Montell	W. Z. Hegy	322.7	47.0	13.0
Ala. C. C. County Line-San Pablo Ave.	A. J. Raisch	H. A. Simard	J. H. Creed	525.9	32.8	10.6
Broadway Tunnel-Orinda Junction	Union Paving Co.	G. L. Beckwith	W. Z. Hegy	375.3	48.0	13.8
Burbank, Buena Vista St.-N. City Limits	Oswald Bros.	C. P. Montgomery	V. O. Sheff	713.8	45.0	14.4
Southern Pacific Railroad-Sherman Way	Griffith Co.	C. P. Montgomery	T. C. Peterson	354.5	43.0	21.6
Third Street, Napa-Suscol Creek (por.)	J. A. Casson Co. & N. M. Ball Sons	G. R. Hubbard	G. R. Barry	534.4	38.0	16.7
Vallejo Township Bus Routes, Project No. 2	Lee J. Immel	G. R. Hubbard	G. R. Barry	490.0	43.0	23.9
Vallejo Township Bus Routes, Project No. 1	Piazza & Huntley	G. R. Hubbard	G. R. Hubbard	485.4	42.0	19.1
S. City Limits Coronado-Naval Air Station	V. R. Dennis Construction Co.	W. T. Rhodes	S. M. Templeton	216.5	49.6	25.0
			Averages	392.0	42.8	18.2

use of side forms. The operation of laying the pavement was broken up into as many courses as was commensurate with the maximum size of aggregate being used. This procedure was followed in order to obtain as much benefit as possible from the repeated leveling action of the machine with each spreading operation.

The grade of asphalt most commonly used was the 85-100 penetration. Plans are being made for the use of considerable 60-70 penetration asphalt in the 1945 program.

The highest **average daily output** of asphalt concrete during 1944 was on Contract 7VC8, VII-L.A-4-Brb, Burbank, Buena Vista St. to North City Limits, where an average of 713.8 tons per 8-hour day was laid by Oswald Bros. C. P. Montgomery was resident engineer, with V. O. Sheff, street assistant. The average daily output for the State was 392.0 tons, compared to 495.7 tons in 1943.

The highest **stability** of surface mixture was obtained on Contract 11ASC4, XI-S.D-Cord, South City limits Coronado to Naval Air Station, with an average of 49.6 per cent. V. R. Dennis Co., contractors, also made the best record in 1943. W. T. Rhodes was resident engineer, and S. M. Templeton, street assistant. The average for the State was 42.8 per cent compared to 43.3 per cent in 1943.

The record for **surface smoothness** was secured on Contract 4WMC3, IV-C.C-69-Rch., E. Cr., Ala.-C.C. County Line to San Pablo Avenue, with an average roughness index of 10.6 inches per mile . A. J. Raisch was the contractor; H. A. Simard, resident engineer; and J. H. Creed, street assistant. The average for the State was 18.2 inches, compared to 17.4 inches in 1943.

Bituminous Treated Surfaces

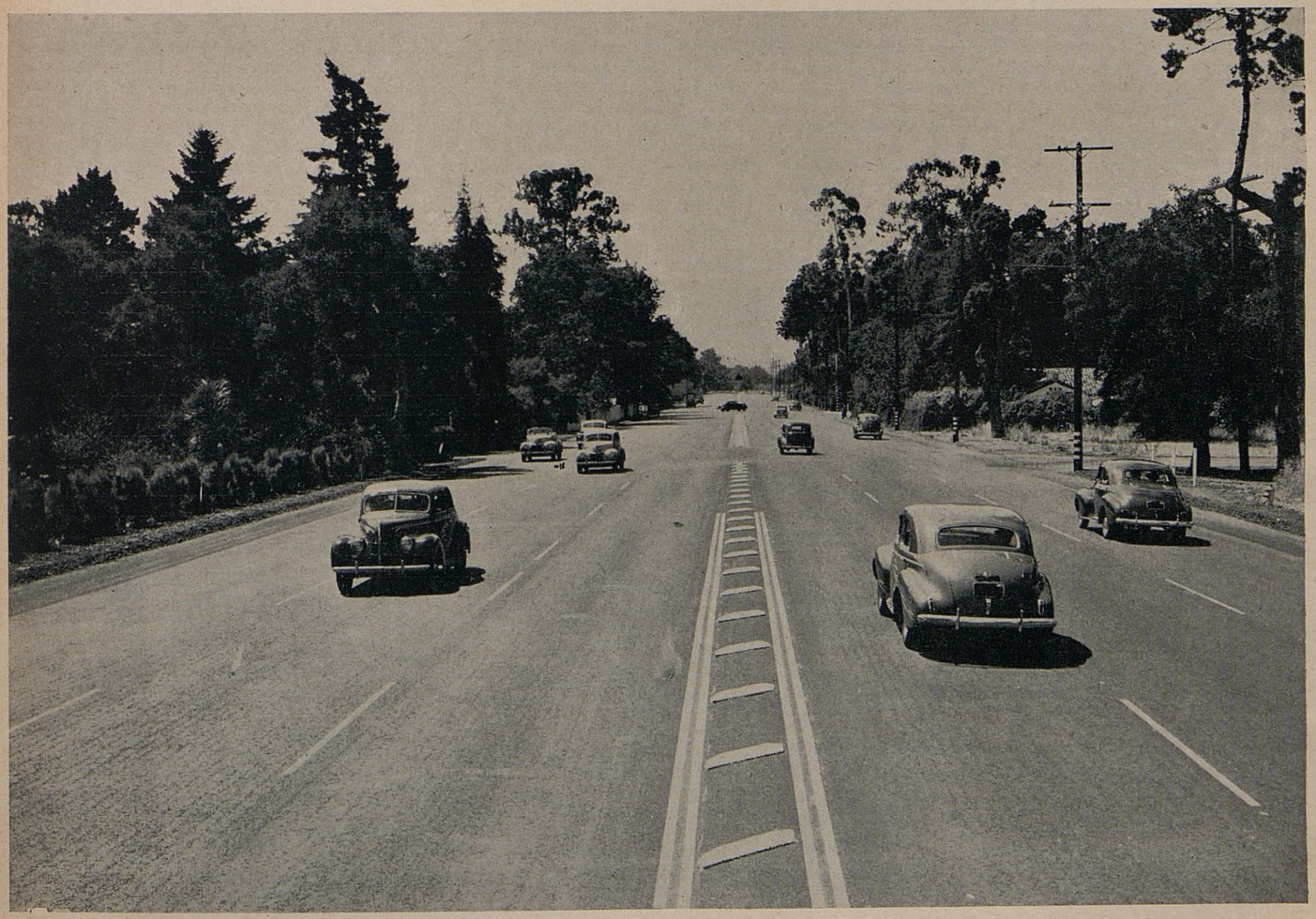
Plant-Mixed

The plant-mixed method of construction was used on 71 per cent of the bituminous treated mileage laid in 1944, and 95 per cent of this surfacing was laid with spreading machines.

A considerable mileage of open graded mixture was laid in 1944. The leveling courses under these surfaces were both dense graded and open graded; the dense graded being used over foundations that were permeable and in which the infiltration of water would cause failure. Open graded surfaces and leveling courses consist of crushed stone with practically all of the fines below the No. 16 sieve removed. The maximum size of aggregate in the leveling course does not generally exceed $\frac{3}{4}$-inch, and in the surface course, it does not exceed $\frac{3}{8}$-inch. To this aggregate is added paving asphalt ranging from 150 to 300 penetration in amount practically the same as is used in dense graded mixtures. The film thickness of the asphalt cover on the aggregate of open graded mixes is considerably greater than that of dense graded, and, in order to maintain this heavy coverage,

(Continued on page 26)

This photograph shows a section of 70-foot asphalt concrete pavement near Redwood City



BITUMINOUS TREATED SURFACES—RECORDS FOR 1944

PLANT-MIX

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
Rattlesnake Summit-Garberville	Clements & Co.	E. F. Richardson	17.9
N. Scotia Bridge-Fortuna	Mercer, Fraser Co.	C. M. Butts	23.3
Route 85-Blue Lake	Mercer, Fraser Co.	J. E. Dessinger	12.3
Morgan Summit-Plumas County Line	Lester L. Rice	F. S. Saunders	11.2
3 miles E. of Paynes Creek-Mineral	Mercer, Fraser Co.	P. F. Duffy	16.0
2.7 miles N.E. of Rush Creek-Chambers Ranch	McGillivray Construction Co.	C. I. Brown	11.7
4 miles S.W. of Adin-2.7 miles N.E. of Rush Creek	E. B. Bishop	C. I. Brown	10.1
Route 87-Oroville Airport	Lester L. Rice	A. C. Irish	17.5
Various sections on Routes 3, 11, 50, Sacramento, Placerville, Yolo Counties	McGillivray Construction Co.	H. A. Towne	18.9
Route 17-U. S. Hospital, N. of Auburn	A. Teichert & Co.	A. C. Irish	38.5
Bretona-Genevra	Clements & Co.	H. A. Towne	14.7
Nelson-1.2 miles N. of Durham	Piazza & Huntley	E. L. Miller	18.8
McConnell Station-Sacramento	A. Teichert & Co.	H. A. Towne	13.0
Biggs Road-Oroville Wye	Piazza & Huntley	E. L. Miller	10.7
Four sections, Routes 3 and 87 Sutter and Yuba Counties	Lester L. Rice	F. D. Hillebrand	7.4
Three sections of road IV-C.C,-75-B,D	Lee J. Immel	P. F. Green	12.6
Willow Pass-Dublin	A. J. Raisch	W. G. Remington	15.4
Napa-Yountville	E. A. Forde	W. A. Rice	11.0
Vallejo-Napa (por.)	E. A. Forde	W. A. Rice	11.7
San Rafael Viaduct-Calif. Park Overhead Bridge	A. G. Raisch	W. A. Rice	29.7
El Cerrito Hill Overhead-Richmond	Lee J. Immel	F. W. Montell	14.4
Dublin-Castro Hill	W. C. Railing	G. L. Beckwith	22.6
San Joaquin County Line-1 mile W. of Mountain House	A. A. Tieslau & Son	W. G. Remington	20.8
Petaluma-San Rafael	A. G. Raisch	W. A. Rice	17.0
Junction Route 106-2.5 miles E. of Antioch	A. J. Raisch	W. G. Remington	14.6
Santa Cruz-Davenport	A. J. Raisch	A. Walsh	27.3
Sequoyah Road, Oak Knoll Blvd.-San Leandro Naval Hospital	Heafey-Moore Co.	L. G. Marshall	21.0
Cebada Canyon-Buellton	Griffith Company	J. C. Adams	27.1
San Luis Obispo County, three sections on Routes 2 and 33	Granite Construction Co.	G. H. Hamlin	13.6
Gaviota Creek-Arroyo Grande (por.)	Brown, Doko & Baun	M. Chapman	19.2
0.8 mi. W. of Pennington Creek-Morro Bay	Brown, Doko & Baun	V. E. Pearson	27.9
Madera-Merced County Line	M. J. Ruddy & Son	R. Windele	15.1
5.1 miles N. of Kern County Line-0.5 mi. S. of Pixley	Brown, Doko & Baun	P. A. Boulton	11.2
Goshen Underpass-3 miles northerly	Brown, Doko & Baun	P. A. Boulton	17.3
Oil King School-Heron Road, Hub-4.6 miles northerly	Brown, Doko & Baun	P. A. Boulton	27.4
Maricopa-Route 4, 0.5 mi.-6.5 mis. E. of Kern River	Griffith Company	J. W. Cole	25.2
2 miles W. of Waco-4.7 miles W. of Famosa	Griffith Company	J. W. Cole	15.4
Monrovia-La Verne (por.)	Pacific Rock & Gravel Co.	H. B. Lindley	14.7
Colorado St.-0.1 mi. S. of San Gabriel River	Owl Truck & Construction Co.	H. B. Lindley	17.7
Solamint-Acton Road, Saugus-Route 23	Schroeder & Co.	H. E. Belford	11.5
San Diego County Line-Doheny Park	Sully-Miller Contracting Co.	H. B. Lindley	19.2
On Vanowen St. and Clybourne Ave. (por.)	Warren Southwest Inc.	C. P. Montgomery	20.1
Trabuco Road, Rte. 2-Marine Base, Central Ave., Rte. 2-Trabuco Road	W. E. Hall Co.	C. L. Gildersleeve	20.4
Figueroa St., Anaheim St.-B St., C St., Hawaiian Ave.-Figueroa St.	Griffith Company	W. D. Eaton	16.1
Ontario St., Woodley Ave., Roscoe Blvd.	Schroeder & Co.	H. E. Belford	21.4
Avenida Dolores, San Clemente, Rte. 2-S. D. Co. Line	Sully-Miller Contracting Co.	W. D. Eaton	16.0
Figueroa St., Adobe St.-Riverside Drive	Vido Kovacevich	C. P. Montgomery	16.6
Lakewood and Rosemead Blvds. (por.)	Vido Kovacevich	W. D. Eaton	15.9
Oxnard-Camarillo	R. R. Hensler	V. O. Sheff	12.5
Routes 178 and 179 (por.)	Sully-Miller Contracting Co.	H. B. Lindley	19.5
Fillmore-Los Angeles County Line	Schroeder & Co.	E. L. Seitz	13.7
Etiwanda Ave., Mission Blvd., Valley Blvd.	Matich Bros.	B. Nelson	16.0
Waterman, Tippecanoe, and Cardiff Aves.	Lewis Construction Co.	E. A. Bannister	18.0
Arlington Ave., Van Buren St.-Magnolia Ave.	George Herz & Co.	J. M. Hollister	13.1
Newberry-Hector	George Herz & Co.	B. Nelson	11.3
Verdemont-Devore, Sycamore Ave.-Cajon Creek	George Herz & Co.	J. M. Hollister	17.0
At Windy Point, Route 26-Palm Springs	George Herz & Co.	J. M. Hollister	20.7
Tippecanoe Ave., 3d Street-Base Line Road	George Herz & Co.	E. A. Bannister	20.1
Vallejo Township Bus Routes, Project No. 3	Piazza & Huntley	G. R. Hubbard	15.6
Vallejo Township Bus Routes, Project No. 2	Lee J. Immel	G. R. Hubbard	17.2
Vallejo Township Bus Routes, Project No. 1	Piazza & Huntley	G. R. Hubbard	20.7
Hammond General Hospital	A. A. Tieslau & Son	F. Noel	11.9
Madera County Line-Merced	M. J. Ruddy & Son	E. L. Craun	13.2
West and East of Fairfield	Sheldon Oil Co.	G. R. Hubbard	11.8
Tracy-Grant Line Road	George French, Jr.	R. K. Wells	13.2
Holt-Stockton	George French, Jr.	R. K. Wells	10.6
San Joaquin County Line-Crow's Landing, and to Modesto	George French, Jr.	R. K. Wells	18.9
Newman-Los Banos	W. C. Railing	George Barry	17.9

BITUMINOUS TREATED SURFACES—RECORDS FOR 1944

PLANT-MIX—Continued

Location	Contractor	Resident Engineer	Roughness Index, Inches per Mile
National City, Concrete Ship Construction Yard-National Ave.	V. R. Dennis Construction Co.	W. T. Rhodes	24.1
S. City Limits, Coronado-Naval Air Station	V. R. Dennis Construction Co.	W. T. Rhodes	25.0
Linda Vista Housing Project-San Diego River	Griffith Company	R. C. Payne	16.4
Escondido-North County Line, Oceanside-Route 77	Southwest Paving Co.	W. T. Rhodes	27.1
San Ysidro-Chula Vista	R. E. Hazard Co.	M. C. Barron	12.0
Mission Valley Road-Linda Vista Housing Project	Griffith Company	R. C. Payne	20.6
		Average	16.8

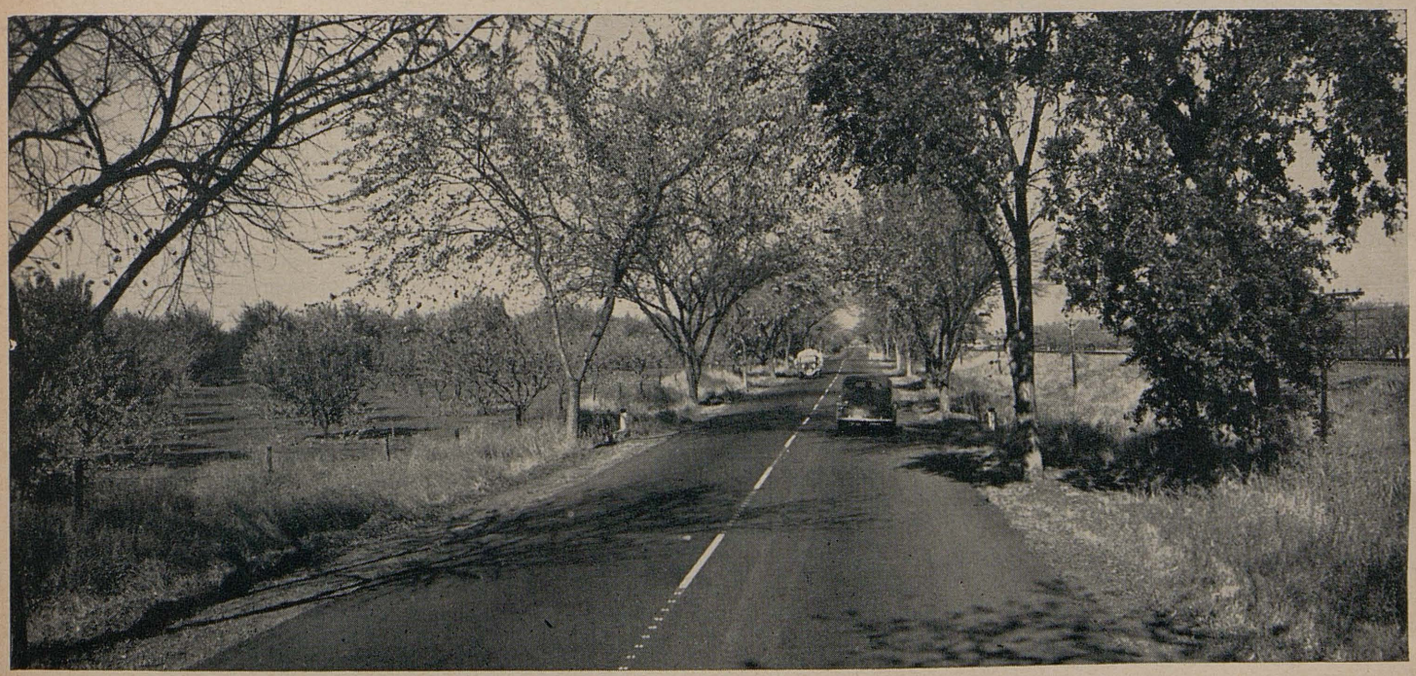
ROAD MIX

Knights Landing-Grimes	W. C. Railing	F. D. Hillebrand	74.1
1.0 mi. E. of Blackwell's Corner-Semitropic School	R. R. Hensler	W. B. Albertson	49.1
Mojave-Ricardo	Basich Bros.	W. I. Templeton	19.0
Antelope School-Route 58	Phoenix Construction Co.	R. F. Johnson	29.4
N. Reservation Gate-Muroc School	R. W. Hampton Co.	R. F. Johnson	38.2
Toyon-West Point	Claude C. Wood	E. L. Craun	29.9
Altaville-Murphy's	Louis Biasotti & Son	A. J. Hull	45.5
Route 65, Sutter Hill-Route 34, 1 mi. W. of Pine Grove	State forces	F. L. Lucas	28.4
1 mi. W. of Pine Grove-Cook's Station	State forces	F. L. Lucas	23.1
Camp Lockett-Route 200	B. G. Carroll	R. C. Payne	15.2
Route 12, Seeley-Camp Seeley	Arthur A. Johnson	F. B. Stewart	20.5
Dixieland-2 mis. E. of Seeley; El Centro-Meloland	Arthur A. Johnson	F. B. Stewart	21.2
Route 26-1.2 mis. South of Thermal	Basich Bros.	M. C. Barron	18.3
		Average	32.9

ARMOR COAT

Trinidad-Little Red Hen	Marshall S. Hanrahan	H. M. Hansen	21.3
0.4 mi. S. of Wilson Creek-Sapp Creek	Close Building Supply	R. A. Miller	42.3
Crescent City-Smith River Bridge	Marshall S. Hanrahan	H. O. Ragan	36.2
Near McClellan Field, E St., 16th-32d St.	A. Teichert & Co.	H. A. Towne	50.7
Belvedere R. R. Xing-Tiburon	A. G. Raisch	W. A. Rice	99.0
5.5 mis. E. of Gilroy-San Felipe	Piazza & Huntley	J. H. Creed	89.9
At Hunter's Point-Donahue St., Jerrold and Kirkwood Avenues	Eaton & Smith	C. T. Ledden	71.6
Seaside Junction-N. Reservation Boundary	M. J. Ruddy & Son	V. E. Pearson	46.7
San Ardo-King City	Granite Construction Co.	J. C. Adams	58.2
		Average	48.3

Plant-mix surface repair project north of Durham in Butte County



CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

Mission Santa Ines September 17, 1804

IN the year 1776, the Franciscan explorer, Fr. Hermenegildo Francisco Garces of Mission San Javier del Bac, Arizona, led an expedition into the interior of California and in Tulare Valley found a warlike tribe of Indians known as the Tulares. Here was a fertile missionary field, but because of the hostility of the natives and the desire of the Franciscans to complete their chain of missions in California no attempt to convert these savages was made for more than two decades.

Twenty-two years after the explorations of Fr. Garces, a military party was sent out from Santa Barbara by Father Fermin de Lasuen, Superior of the Missions, with instructions to locate a suitable site for a station between Mission Santa Barbara and Mission La Purisima Concepcion. With this force went Father Estevan Tapis.

Fate decreed that Fr. Tapis not only was to be the discoverer of the spot on which the new mission, Santa Ines, was to be located, but the founder as well. Four years later, on September 17, 1804, he raised the cross, blessed the water and site and established the nineteenth of the California missions on a rancheria called by the Indians Alajulapu and which today is located three miles east of Buellton in Santa Barbara County. Fr. Tapis then was Superior of the Missions, having succeeded Fr. Lasuen, who died before he, himself, could found the new station.

TULARES FIERCE TRIBE

Mission Santa Ines was placed in a valley between the Santa Ines and San Rafael mountains inhabited by Indian tribes that maintained intercourse with the fierce savages called the Tulares. It was the hope of Fr. Tapis that through mission converts he could carry Christianity to the pagans of the eastern Sierra.

Fr. Tapis baptized 27 children of natives the day he founded Santa Ines, which he dedicated to Virgin and Martyr, Saint Agnes. Fr. Tapis left Fathers Jose Antonio Calzada and Romualdo Gutierrez in charge. At the close of the year, Santa Ines had 112 Indian converts and at the beginning of 1806 its rolls carried a total of 570 neophytes, including 132 from Mission Santa Barbara and 145 from La Purisima Concepcion.

From 1804 to 1812 an extensive building program was carried on. The walls of the church, habitations for the padres, dwellings for the soldiers and their families, adobe homes for the Indian converts, warehouse, granaries and other structures were of adobe and about 30 inches thick. In the year 1812 more than 80 houses were built.

EARTHQUAKE DAMAGE

On December 21, 1812, much of the work of the padres was undone by an earthquake which rendered the church unserviceable and demolished the walls of many of the mission buildings. The following year a long structure was erected to serve as a church and it was not until 1817 that the new church, the ruins of which stand restored today, was completed. It was dedicated July 4, 1817. Its interior was modeled after the Santa Barbara mission temple. Fr. Francisco Xavier Uria and Fr. Ulibarri continued building operations up to 1824 and obtained many beautiful vestments, furnishings and other church goods. When Fr. Uria took charge in 1808 there were 441 converts. His last baptism on February 17, 1824, was numbered 1227.

Beginning in 1810 when Mexico's revolt against Spain began, Mission Santa Ines, in common with the other missions, received no further aid from Mexico and was compelled not only to support itself but to provide food, clothing and money for the garrison at Santa Barbara. The Santa Ines Indians resented being compelled to work for the idle soldiers and this resentment flared into rebellion on February 21, 1824. As we have seen in the story of Mission Santa Barbara, the uprising extended to that station and to Mission Purisima Concepcion.

The Indians set fire to many buildings at Santa Ines, but when it appeared the flames would destroy the church their anger subsided and they helped save the edifice. All the workshops, soldiers' barracks and habitations of the guards were destroyed. The revolting natives fled to the Tulares, after causing great destruction

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into northern Washington.

Present day State highways lead to all the mission sites. When the war is ended and California again welcomes tourists from all over the world and there are no longer restrictions on automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways will publish in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions will be taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the fifth of the series.

Mission Santa Ines, restored to its former architectural beauty, as it looks today

at Santa Barbara and Purisima Concepcion. Several of them were killed.

In a letter to Don Lucas Alaman, Minister of Relations, in Mexico, the Fr. Guardian of the College of San Fernando de Mexico, sponsor of the Franciscan missions, wrote:

INDIANS COMPLAIN

"The revolt was not against the missionaries; on the contrary, the revolting Indians wanted to have the Fathers go along with them, and told them they would be cared for. * * * It may be said with truth that the missions alone, or the labor of the down-hearted neophytes, have sustained the troops since 1810. The Indians complain bitterly that they are toiling so that the soldiers may eat, and that they receive nothing for their labor."

During all the period from the revolt up to 1834, when Mission Santa Ines was fighting to survive under the oppression of a succession of civil administrations in California, the resident padres continued building. In August, 1834, all the missions were secularized but Santa Ines was not violently dealt with until 1836. In June of that year, the newly appointed Governor, Mariano Chico, en route from Monterey to Los Angeles, arrived unexpectedly at Santa Ines.

Fathers Jose and Antonio Jimeno had not been notified of the Governor's coming and were unprepared to receive him ceremoniously. Chico professed to be highly insulted and proceeded on to Santa Barbara, where he demanded of Fr. Presidente Duran that the two padres forthwith surrender the mission to Jose Maria Ramirez, civil commissioner. Because Fr. Duran defended his colleagues, he was ordered banished by the Governor, but, as related in the story of Santa Barbara, the people of Santa Barbara sided with the Fr. Presidente and prevented execution of the order.

DEPLORABLE CONDITIONS

Mission Santa Ines was turned over to Ramirez in July, 1836, and he placed it in charge of Jose M. Covarrubias, who was named administrator. The mission and property were valued at $56,437.62, less debts amounting to $5,475. A year later, Francisco Cota became administrator. When William Hartnell, inspector for the missions under Governor Alvarado, arrived at Santa Ines in May, 1839, he found conditions there deplorable.

Manuel Micheltorena came from Mexico to California as Governor on August 25, 1842, with instructions from the Mexican Government to return all missions to the Franciscans. On March 29, 1843, he carried out these orders in an official decree. And on March 16, 1844, Micheltorena, at the request of Father Jimeno and Juan Moreno of Santa Ines and Fr. Francisco Sanchez of the seminary at Santa Barbara, deeded to the padres land on which to erect a seminary college, granted them $500 a year for school maintenance and later gave additional land which placed a total of 35,499 acres under control of the college.

The plan for an ecclesiastical seminary was conceived by Bishop Francisco Garcia Diego y Moreno and on May 4, 1844, with the bishop and other church dignitaries present, the College of Our Lady de Refugio was founded. The happiness of the bishop and the fathers of Santa Ines was destroyed a year later when Pio Pico and his followers drove Micheltorena out of Cali-

fornia and Pico immediately schemed to confiscate the mission and its lands.

PICO ENEMY OF MISSIONS

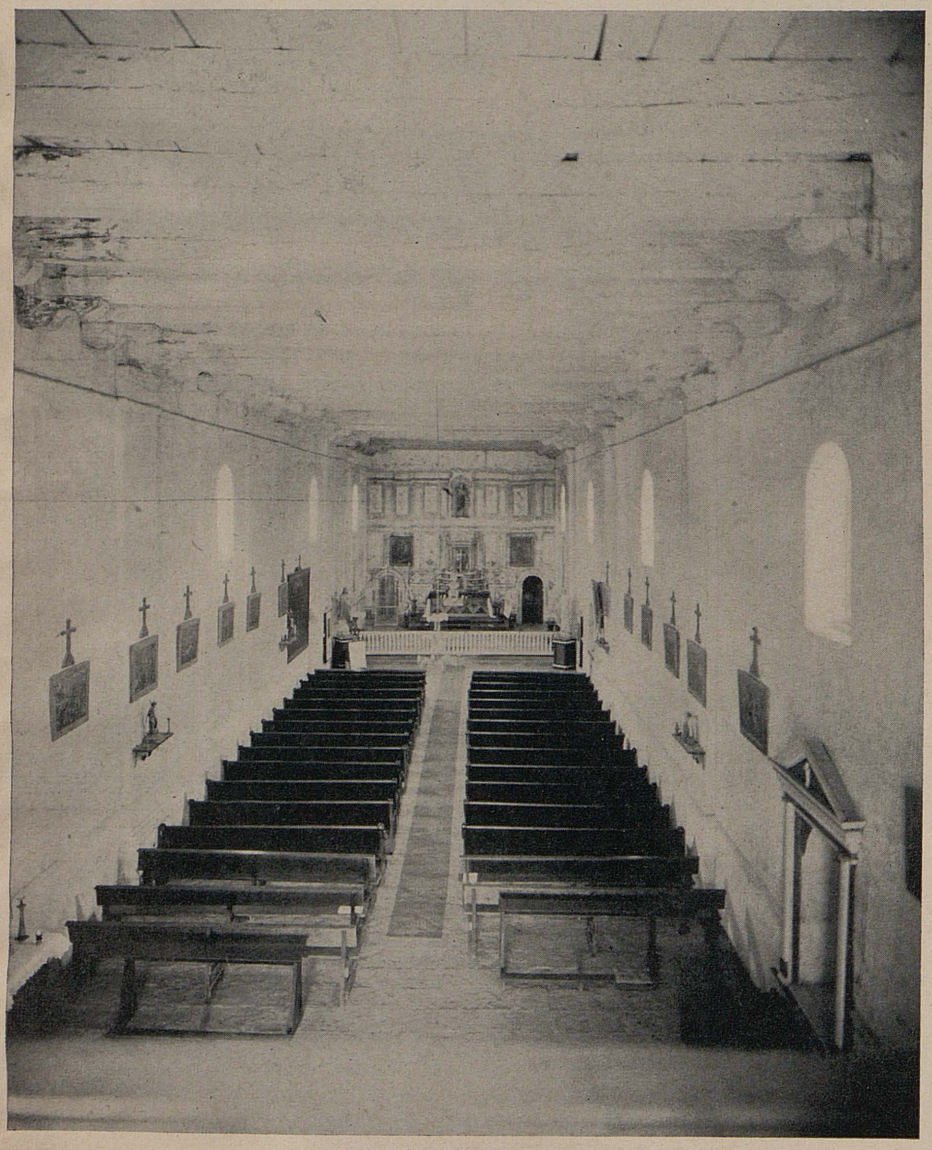
"The principal object which guided me," Pico wrote in his Narracion Historica, "was to make the rule of the missions disappear completely."

Pico succeeded in doing just this. He first leased and then sold Santa Ines to Jose M. Covarrubias and Joaquin Carrillo for $7,000 on June 15, 1846. Three weeks later the American flag was raised at Monterey and Pico fled to Mexico, leaving the ruined California missions behind him.

Fr. J. J. Jimeno and Fr. Francisco Sanchez continued to conduct the college until May 7, 1850, when they turned the institution over to Rev. Theodosius Bousseier and Rev. Felix Migorel of the Congregation of the Sacred Hearts of Jesus and Mary. In 1868 the Franciscan Brothers took charge and in turn were succeeded by the Christian Brothers, who took over in 1877 at the request of Archbishop Alemany and served until 1882, when the school was closed and the college's 36,000 acres sold by Alemany for the diocese. The mission had been returned to the Catholic church on May 23, 1862, by President Lincoln.

One of the most interesting periods in the modern day history of Santa Ines began in November, 1882, when Fr. Michael Lynch, who had succeeded Fr. Juan Basso in 1875, invited Thomas James Donohue and his family of Gilroy, to come to the mission to live.

This is the chapel of Santa Ines Mission as the padres of old knew it



Donohue was a carpenter and stone mason and he and his sons made many needed repairs with the help of Fr. Lynch and Fr. Farrelly. Donohue's daughter Katharine, has written a most interesting account of the years they were at Santa Ines. She tells of Old Rafael, aged Indian, who devotedly took care of the church for many years and of Fernando Cardenas, known as Fernandito, who came from Ecuador as a boy and lived his life at Santa Ines, a beloved character. He died at Santa Barbara in 1919.

FATHER BUCKLER'S EFFORTS

In June, 1904, Fr. Alexander Buckler was appoitned pastor of Mission Santa Ines and of Lompoc and Sisquoc and the surviving Indians. He was directed by Bishop Thomas James Conaty, D.D., of Los Angeles, to restore the mission buildings. He labored at this task faithfully until his death on March 7, 1930. He was assisted by his niece, Miss Mary Goulet, who came from Minnesota to aid him. She is the author of a priceless record of Father Buckler's heroic efforts to restore the old mission.

Mission Santa Ines is what it is today because of the work of Fr. Buckler and his niece, Bishop Conaty and the Native Sons of the Golden West. Also credit must be given to Fr. Buckler's "Dick Turpins," as he called them. They were tramps, hobos and wayfarers who happened by the mission over a period of years and were fed, housed and put to work on the mission by the padre.

Unprecedented rain storms in the spring of 1911 threatened complete destruction of Santa Ines, but Bishop Conaty and the Knights of Columbus of Los Angeles came to the rescue with funds and restoration was continued. The centenary of the mission church's dedication was celebrated on July 4, 1917.

Mission Santa Ines, at Solvang, lies 37½ miles north of Santa Barbara via scenic San Marcos Pass and the little town of Santa Ynez. This route traverses a delightful, undisturbed countryside. Another route to the Santa Ines Mission, which is about ten miles longer, is via the Coast Highway, skirting the ocean the greater part of the way. This scenic highway leads into historic Gaviota Pass, and over the hills through Las Cruces and Buellton by a newly constructed road, the magnificent engineering of which has eliminated grades and dangerous curves. Visi-

tors in Santa Barbara, having Mission Santa Ines and the northern part of Santa Barbara County as a goal, are advised to go one route and return the other. In this way they may derive the greatest pleasure from the scenic delights along both routes.

Motorists from the north may travel the Inland Route from San Francisco, State Highway No. 4, to Bakersfield, drive south 20 miles to State Highway 57, turn west to Maricopa and follow 57 to Santa Maria on the Coast Highway, proceeding thence south to Buellton and then three miles east to Mission Santa Ines. The other route from the north is over the Coast Highway No. 101, to Buellton.

This corridor vista charms visitors to Santa Ines Mission

La Purisima Concepcion December 8, 1787

ESTABLISHED on the day dedicated to the Singularly Most Pure Mystery of the Empress of the Heavens, Mary Most Holy, that is to say of her Immaculate Conception, as Fr. Guardian of the Missions Fermin de Lasuen, its founder recorded, Mission La Purisima Concepcion was foredoomed to tragedy .

Eleventh of the Franciscan Missions erected on El Camino Real, bringing nearer to reality the dream of Fr. Junipero Serra for a chain of missionary stations stretching from San Diego to San Francisco, Purisima Concepcion came into existence on December 8, 1787.

Its beginning delayed by the animosity of Governor Felipe de Neve, its first church and mission buildings totally destroyed by earthquake, long years of work by its faithful padres undone by an Indian revolt and its ruin finally accomplished by political intrigue, Purisima Concepcion of beautiful name furnishes a tragic chapter in the history of the old California missions.

In opposition to the expressed wishes of the Viceroy of Spain in Mexico, Governor Neve had succeeded in preventing the founding of Mission Santa Barbara and Purisima Concepcion for many years, but in August, 1786, Governor Pedro Fages communicated to Fr. Lasuen the welcome news that the Viceroy had ordered the establishment of a new mission on the Rio de Santa Rosa, now known as Santa Ynez River. And so Fr. Lasuen in a happy frame of mind set up the eleventh Franciscan station, ninth on the Road of the Padres from south to north.

BUILDING OPERATIONS BEGIN

Building operations began in the spring of 1788 and by the end of that year ninety-five baptisms had been solemnized and twenty-five marriages blessed. Records of activities at the mission up to 1794 are rather sketchy, but reveal that the Fathers steadily carried on with their construction work.

In December, 1798, Fathers Gregorio Fernandez and Antonion Calzada reported that "there are now 920 souls here, and the number, it is hoped, will be much greater with the favor of God."

The padres made great headway with the Indians and recorded that "paganism here has almost ceased." While no records are available, it is certain that the missionaries proceeded with the erection of a suitable edifice and with other building activities for in his biennial report 1800-1802, Fr. President Lasuen wrote:

"In the Missions of Purisima Concepcion and San Luis Rey they have in each one completed their church of adobe, sufficiently large and very becoming."

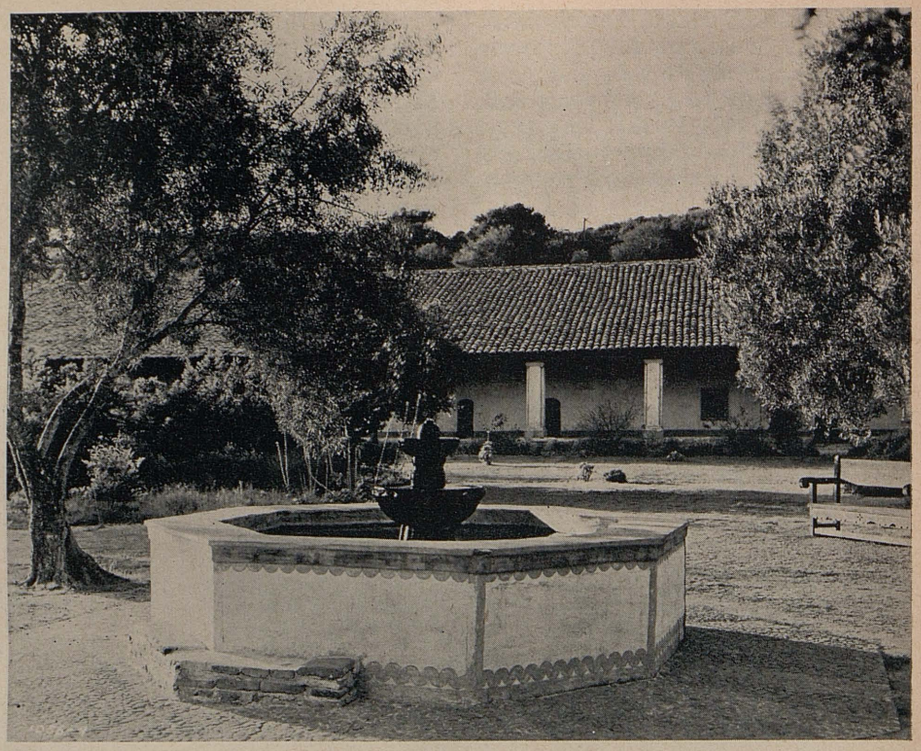
FEW RECORDS

"And that," says Fr. Zephyrin Engelhardt, Mission historian, "is all we find recorded anywhere about the church, the ruins of which are still seen

on the southern end of Lompoc at the foot of the mountain, within three blocks of the Catholic Church. We may presume that the dedication ceremonies took place on the titular feast, December 8, 1802, and that the Fathers of Santa Barbara Mission, as well as those of San Luis Obispo, participated in the festivities."

Between 1805 and 1808 the Mission fathers and their neophytes constructed an aqueduct, purchased 2,000 additional head of cattle and added to the mission buildings. It is interesting to note from old records that Fr. Mariano Payeras, reporting to the Fr. Presidente in January, 1810, wrote that he had completed compilation of "a large catechism with the acts of Faith, Hope and Charity, and another with what is necessary for salvation, a complete confesionario (a booklet explaining all about confession), and other little things, all in the language of these natives." It must have been some task.

The good Father also reported that the mission had 10,000 sheep and as many cattle. Temporal affairs at the mission were progressing steadily when calamity befell Purisima Concepcion in December, 1812.



This fountain replaces the original one built by the founders of Mission La Purisima Concepcion

NEW MISSION SITE

The earthquake of that year which created so much havoc at several of the California missions entirely destroyed the church and vestry, buried under the wall the various images and paintings, ruined the greater part of the church furniture and made uninhabitable most of the mission buildings. So great was the damage that the padres petitioned the Fr. Presidente and governor on March 11, 1813, for permission to remove the Indian community to another site and establish a new mission. Governor Arrillage granted the request and nine months later received a report which said, in part:

"This Mission of Purisima, founded in the plain south of the Rio Santa Rosa, or San Bernardo according to the map of Lopez, on the spot called Alsacupi by the natives and which was destroyed by the dreadful earthquake suffered from December 21 to the last days of the year 1812, was on April 23, 1813, moved to the dale called Los Berros by the Spaniards, but Amuu by these natives. The site of the new mission lies five quarter leagues northward of the old mission in the plain north of said river, on the Camino Real from Santa Ines to San Luis Obispo. It is 2,300 varas wide from west to east. While the old place lay away from the public highway, the new site is one league nearer to Santa Ines, and one-fourth league nearer to San Luis Obispo."

Ten days before the catastrophe the mission books had recorded 2,597 baptisms. In 1804 a total of 1,520 Indian neophytes were living happily at the mission.

FATHER PAYERAS HONORED

With supreme courage, Fr. Payeras and Fr. Ripoll set about building a new mission and by the end of 1813 had gathered about them 1,010 Indians. On July 24, 1815, the College of San Fernando de Mexico honored Fr. Payeras by appointing him Presidente of the California Missions.

During 1818 the temporary church collapsed, but another church was erected on the same site. This edifice, intended to be temporary, seems to have continued to be the permanent house of worship as records fail to show that it was replaced.

Worn out by his labors, Fr. Payeras died at his mission on April 28, 1823. Purisima Concepcion gradually was being impoverished by the excessive demands of the California military government that it contribute heavily to the support of the soldiers and their families. Money that the padres wished to devote to their new mission had to go to the army together with food and clothing.

OPPRESSION BY MILITARY

It was this oppression by the military that brought about the uprising of Purisima Indians on February 21, 1824, a revolt that spread to Santa Ines and Santa Barbara, as we have seen in the chapters on those two missions. A number of Indians were killed and seven were executed for their part in the affair, all of them young men. The older natives did not take part in the rebellion.

Jose M. Echeandia, first Mexican governor of California, arrived in 1825 and connived with young California politicos to seize Purisima Concepcion, along with the other missions. Final legislation confiscating the missions was not published until November 4, 1834, but for some reason haste was made to obtain the lands of Purisima and on November 30th of that year Domingo Carrillo was named civil commissioner to take over the property. The mission and its possessions were appraised at $61,976.37 less debts of $1,218.87, on February 18, 1835, and on March 1st delivery was made to Carillo.

Upper—Ruins of Mission La Purisima Concepcion before restoration work was begun *Byron Dome Photo*

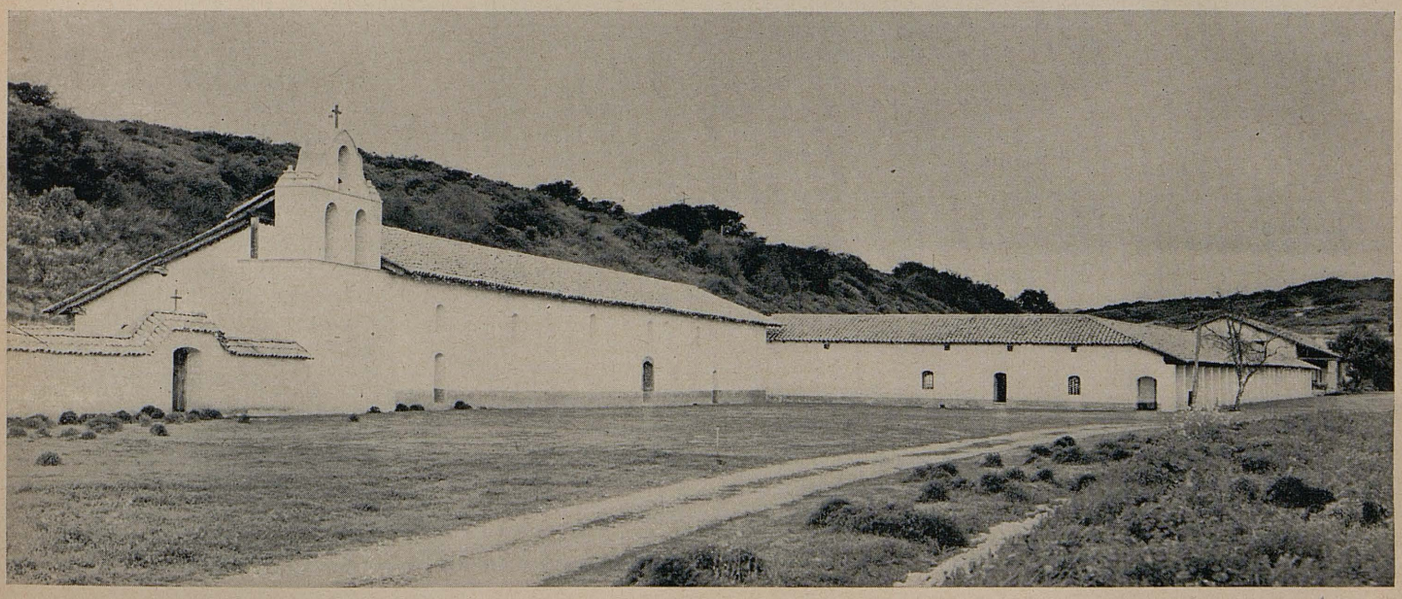
What destruction was wrought at Purisima in a few short years is revealed by a report of William E. P. Hartnell, Inspector of Missions under the civil government and a friend of the Franciscans, submitted in January, 1839. Hartnell reported 122 Indians at the mission, most of them ill and in need of food and clothing. He ordered 300 cattle killed to purchase $800 worth of clothing for the neophytes.

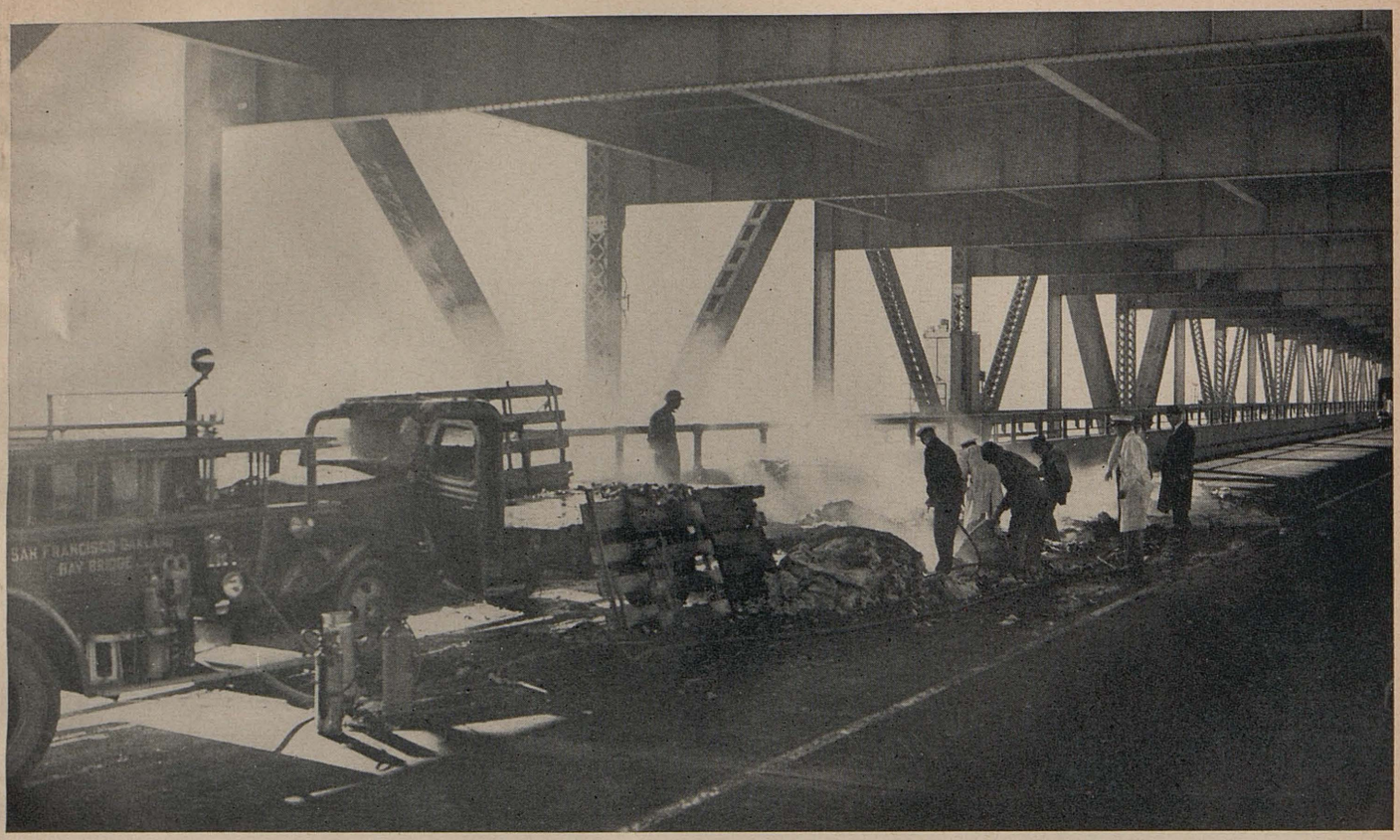
During 1841-1842, Jose Antonio de la Guerra was administrator at Purisima and he is charged with having dissipated what was left of the mission property. Preceding chapters of this little history of the missions have dealt with the effort made by Governor Manuel Micheltorena to restore the missions to the Franciscans, of his banishment from the country by Pio Pico, who proclaimed himself Governor, and of Pico's sale of the California missions to various political friends. It is not necessary to repeat those sad facts here.

On December 4, 1845, Pico sold Purisima Concepcion to John Temple for $1,110.

"Thus," says Fr. Engelhardt, "came to an end Mission Purisima Concepcion within two days of the 58th anniversary of its founding by Fermin de Lasuen, the successor of Fr. Junipero Serra." (Continued on page 27)

Mission La Purisima Concepcion looks today exactly as it did in the years of its glory





This photograph shows what happened on the Bay Bridge when a cigarette was carelessly thrown into a truck load of mattresses

Bay Bridge Maintains Fire Department

By C. S. HAMILTON, Associate Bridge Engineer

CONSIDERING the current popularity of radio quiz programs, we offer as the $64 question, "What does a fire department do on a steel and concrete bridge?"

While such a question may have no particular meaning when applied to the ordinary river crossing, it is quite pertinent on the huge San Francisco-Oakland Bay Bridge. On this structure fire is of sufficient potential hazard to bridge property and the public as to warrant the employment of a permanent fire department as a unit of the bridge maintenance forces. Nor is this hazard merely a theoretical one. The history of the bridge since the opening day in November, 1936, to date, has amply justified the assignment of men, equipment, and material to this fire-fighting function. It could well be that the continued use of the bridge by its many patrons is due in no small part to the constant vigilance and ready availability of the bridge fire department.

The main bridge fire equipment is centrally located for speed in action. The fire station is housed at Yerba Buena Island at the approximate center of the bridge. Roadway connections at this point provide ready access to the upper and lower decks of the structure in either direction. Permanently stationed at this location is a modern fire truck equipped to cope with the particular fire situations that may arise on the bridge. From this central point the fire truck can respond in a few minutes to any point on the 12½ miles of bridge and approach roadway and 4½ miles of bridge railway under the jurisdiction of the San Francisco-Oakland Bay Bridge unit.

The fire truck is an American-La France unit on a G.M.C. chassis and carries the following equipment:

1 300-gal. water tank connected to a Byron-Jackson 2-stage centrifugal pump delivering 120 g.p.m. at 130 pounds pressure.

700 feet of 2½-inch and 1½-inch hose for the above unit for hydrant pumping and 150 feet of ¾-inch chemical hose.

40-gal. Foamite tank operated by compressed nitrogen and equipped with 200 feet of ¾-inch hose and shut-off nozzle.

1 running-board-mounted Model 10 Foamite generator with 100 feet of 1½-inch hose and nozzle. Six 50-pound cans of Foamite compound are carried on the truck to serve the generator unit.

10 portable extinguishers made up by three 2½-gallon Foamite units, two 1-gallon carbon tetrachloride units, two 15-pound carbon dioxide units, two 1-quart Pyrene units, and one 2½-gallon plain water unit.

ADDITIONAL EQUIPMENT AVAILABLE

Auxiliary bridge fire-fighting equipment has been provided by installing small gasoline-engine-driven centrifugal pumps and hose on two 580-gallon truck-mounted water tanks normally used by the bridge painting crew for preliminary cleaning operations, and by installing a pump and pertinent equipment on the bridge maintenance boat *Active* for possible use on certain bridge piers having a timber protection fender. The *Active* is a 14-ton launch of 42-foot length and 12-foot beam powered by a 3-cylinder, 50 H.P. Corliss marine engine. The boat was used by bridge engineers during construction and on completion of that operation was assigned to the bridge maintenance forces. The fire-fighting equipment mounted on the boat consists of a Chrysler-Hale auxiliary fire pump of 500 g.p.m. rated capacity, 200 feet of 2½-inch and 1½-inch hose and a monitor nozzle mounted atop the pilot house. At the rated capacity the pump readily develops 125 pounds pressure.

All maintenance automotive equipment assigned to the bridge carries hand extinguishers which have been of frequent use in suppressing incipient fires without the necessity of calling for the larger units.

A 10-inch water main from San Francisco to Yerba Buena Island is installed on the West Bay crossing of the bridge. Fire hydrants at frequent intervals on this line provide ample water supply in case the portable supply should prove insufficient. A 12-inch water main now under construction from Oakland to Yerba Buena Island will shortly provide similar facilities on the East Bay crossing.

Harbor piers on the San Francisco waterfront, immediately adjacent to the bridge, are equipped with automatic sprinkler systems for bridge fire protection. These systems were installed by the bridge and are maintained by bridge forces.

COMMUNICATION SYSTEM

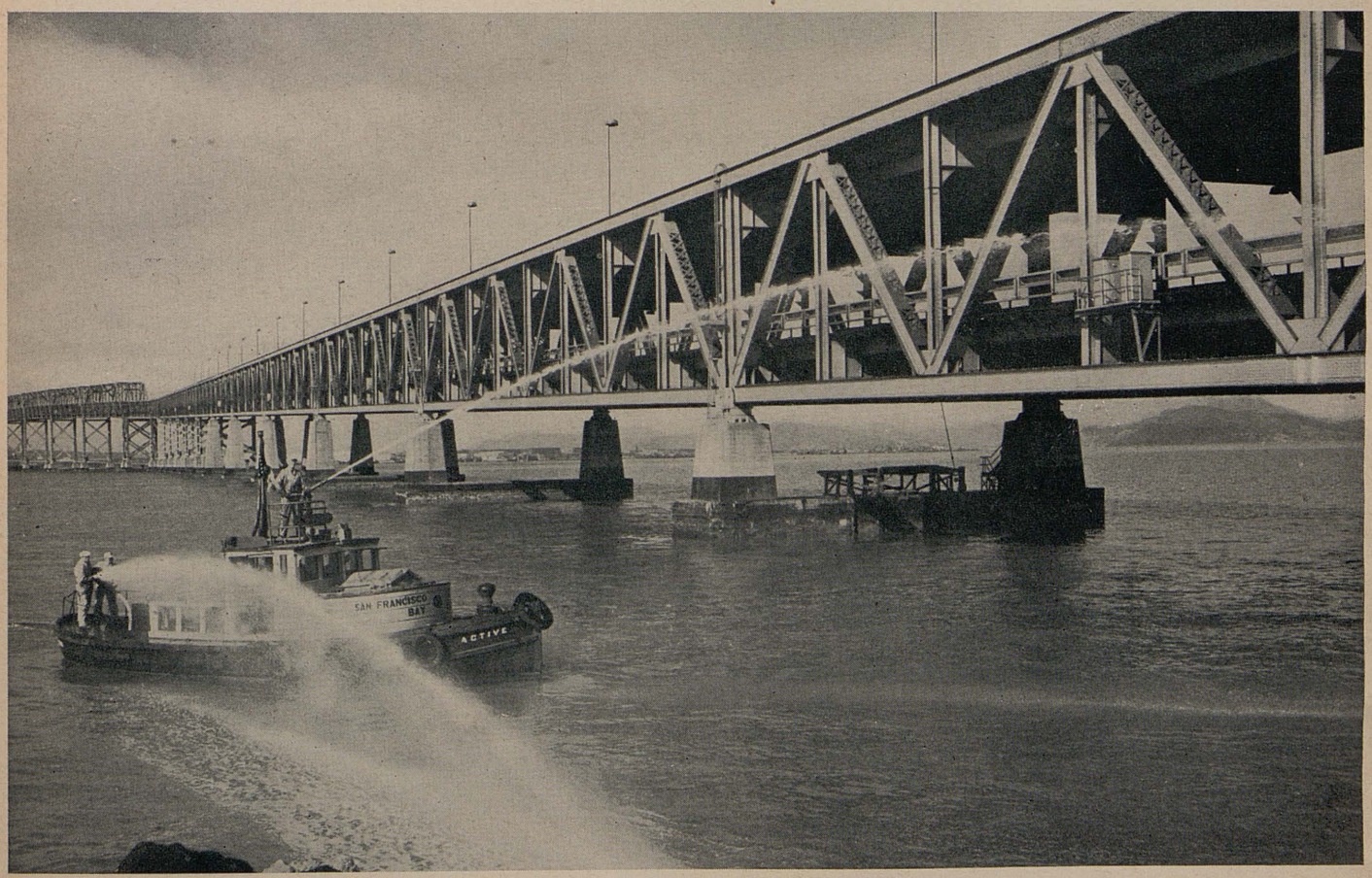
Reporting into the firehouse are the 54 fire alarm boxes distributed at intervals along the bridge and approach roadways for the use of the public and bridge employees. A terminal receiving instrument permanently records date, time, and location of all alarms transmitted on the system and, by the action of the fireman in resetting the box, records the same information for the response to a call.

The alarm system also reports each call and reset into the administration office of the bridge, located at the toll plaza. Auxiliary boxes at each end of the bridge connect the bridge system with San Francisco and Oakland systems so that the fire departments of these cities may be called if the bridge fire department needs outside assistance. A mutual aid arrangement has been agreed on with the Navy Fire Department at the Treasure Island Base, adjacent to Yerba Buena Island, thus providing another source of outside help on specific call.

Bridge maintenance phones provide additional communication into the firehouse and augment the coverage of the bridge alarm system.

The fire fighting forces are a part of the bridge maintenance and emer-

Maintenance boat "Active" throws a stream of water onto Bay Bridge during fire drill



Truck-mounted tanks are 580-gallon capacity equipped with small, centrifugal pumps for fire fighting purposes on Bay Bridge

gency service forces under the direct supervision of the Highway Maintenance Foreman. During the day shift, when assistance is readily available on the bridge, one fireman only is on duty at the firehouse. On the remaining two shifts, two men are assigned. Should a night emergency arise, maintenance employees can be summoned on reasonably short notice.

Permanent employees of the maintenance department have been given a six-day training course in the San Francisco Fire Department Training School. Twenty-three men have had this training to date and, while some of these employees are no longer with the bridge, there remain a nucleus adequate to cope with any emergency to be expected.

FIRES OF FREQUENT OCCURRENCE

Since the bridge opening the fire department has been called upon to extinguish some 420 fires, or an average of 4.2 fires per month. The average over the years 1943 and 1944 was slightly higher at 5.0 fires per month, reflecting, no doubt, the lack of maintenance on autos and trucks during the war years. Although the number of actual fires average but 5.0 per month, the bridge fire truck is called out on an average of about 14 times per month. These extra calls may be false alarms, standby service at wrecks, or other equally pertinent reasons.

As might be expected, the greater number of fires occur on vehicles, but railroad ties and grass, brush, and rubbish on bridge approaches have contributed a share to the record. Some selected figures may be interesting to the reader as typical of the duties the fire department performs and, incidentally, may indicate a few matters the motorist should watch for the protection of himself and others:

Type of Fire

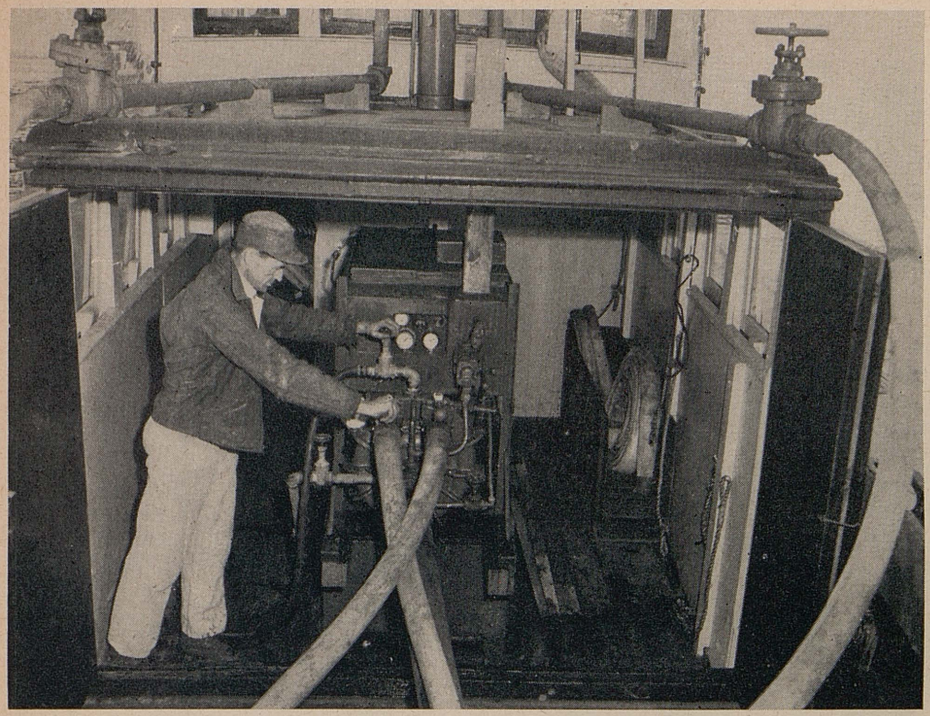
Auto	**130**
Truck	**56**
Bus	**18**
Railroad	**27**
***Miscellaneous**	**24**

* Grass, brush, rubbish; fires on Yerba Buena and Treasure Islands, etc.

Contributing Factors

Brakes	**33**
Ignition	**30**
Motor trouble	**16**
Cigarette in upholstery	**41**
Fuel system	**10**
Exhaust system	**32**
Rags on motor	**13**
Cigarette in cargo	**12**
Wreck	**10**
Unknown	**33**

The majority of railroad fires occur in the timber ties as the result of a cigarette carelessly thrown from a passing truck, from insulation failure on the third rail, or from electrical shorts caused by metallic objects blown from trucks on the paralleling roadway. Nearly all such fires are minor in character and quickly extinguished, but one or two have occurred during periods of north wind with resultant low relative humidity. On these occasions the fire may be very persistent and difficult to extinguish. One such occurred on April 13 of this year. Located on the East Bay cross-

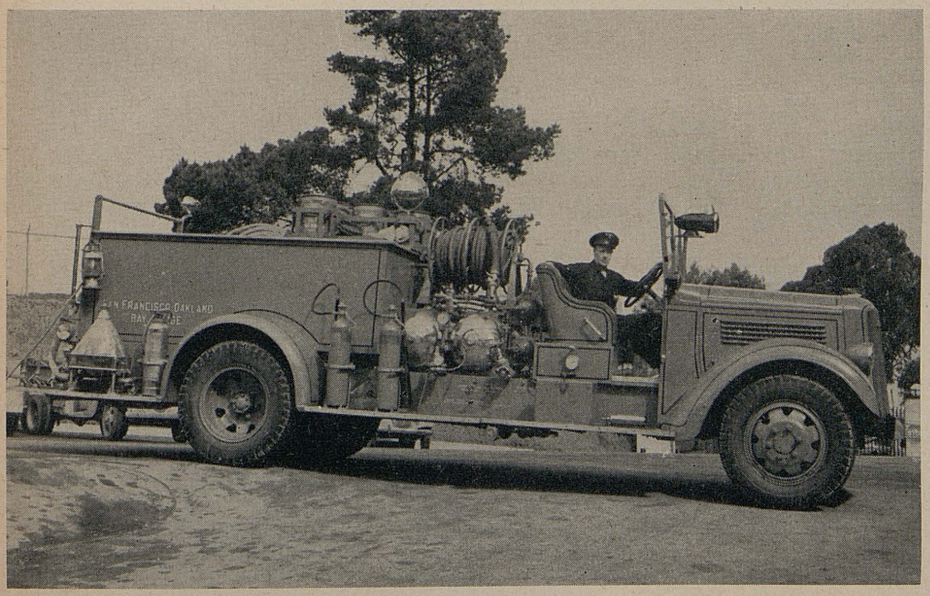


Closeup of auxiliary fire pump on boat "Active"

ing, it was caused by a sheet of corrugated iron blowing from a passing truck onto the railroad right of way to be subsequently caught in the third rail shoe of a passing train. The resulting series of shorts caused a sequence of fires extending over 1800 feet of track. Although the more serious part of the fire was limited to about 900 feet of track, a 20-mile north wind, combined with a relative humidity of 45, presented a difficult problem for fighting with the limited water supply.

On this occasion all available bridge equipment and outside aid from all sources previously mentioned were occupied for over an hour in extinguishing the fire. Train, truck, and bus traffic were delayed one hour and 40 minutes by the incident. Fortunately the quick response of fire apparatus prevented any structural damage to the bridge.

Fire truck unit operated by Bay Bridge



Bridge Maintenance

(Continued from page 8)

traffic constituted an important factor, sidewalks have been bracketed to the outside of through trusses in order to allow vehicles to utilize the full width of the roadway.

The improving of vertical clearances, particularly as restricted by portal and other diagonal bracing near the edges of the roadway, not only acts to prevent damage to the truss, but also adds to effective width by allowing the higher vehicles to hold to their half of the roadway. This is accomplished either by raising existing bracing or by replacing with a new section of equal strength which provides greater traffic clearances.

The recent replacement of the main trunion braces at the Petaluma Creek Bridge—before and after pictures of this repair being shown in **Photos 7 and 8**—is of this latter type. It was necessary to maintain adequate bracing at all stages of the repair since this bascule truss is raised several times each day for the passage of river traffic. The four-angle existing braces were separated and each pair of angles was successively removed, shortened, and bolted to the outside of the gusset plates, in order to allow the new sections to be inserted between the gussets. Self-locking bolts were used in lieu of rivets in attaching the new braces to the existing truss. The effective minimum vertical clearance was increased from 10 feet 6 inches to 14 feet by this repair.

THREE STATES INCREASE GAS TAX

Three States, Kansas, Idaho and Iowa, have increased their gasoline taxes in legislative sessions this year, reports to the National Highway Users Conference as of April 3d show. The one cent increase in Kansas will not become operative until after the war emergency and revenue derived from the increase will be applied to amortization of anticipation warrants, receipts from which will be used to match Federal-aid funds during the first three postwar years. The increase will expire when the warrants are paid in full.

The one cent boost in Idaho is for the purpose of matching Federal-aid highway funds and in Iowa two-fifths of the one cent tax raise will be used for secondary roads and the remainder will go to cities.

Gilman Street Improvement

By F. M. CARTER
Assistant Traffic Engineer

THE establishment of the Naval Force Equipment Depot on the bay side of the Eastshore Highway at Gilman Street increased the movement of heavy equipment and of pedestrian traffic to such extent that immediate attention was necessary.

For several years even though Gilman Street was a direct connection to a residential and business district in Berkeley, the majority of traffic proceeding to Oakland and San Francisco by the Eastshore Highway was using University Avenue.

Gilman was used largely by trucks and vehicles going to the city dumps. Even with the beginning of the war and the increase of vehicles on the Eastshore Highway, traffic was encouraged to use University Avenue because it was channelized and controlled by full actuated traffic signals. The majority of the movements from University Avenue were turning and the controls made safer and easier traffic movements.

The construction of the Golden Gate Turf Club again presented the problem of crossing the Eastshore Highway at the Gilman Street intersection and plans were made to handle the expected traffic, but this project did not materialize.

The traffic engineering studies made previously proved conclusively that the intersection would require left turn storage lanes and full traffic actuated signals, the same type as already in use on all other traffic controlled intersections on the Eastshore Highway.

With the full cooperation of the Public Roads Administration and the Navy, necessary priorities were obtained because this work was a war necessity.

The design for Gilman Street was the same as at other intersections on the Eastshore—three lanes for each direction of traffic on the highway and storage lanes for traffic turning left from the highway.

These storage or left turn lanes are indentations in the center divisional strip. On the Eastshore Highway the opposing traffic lanes are divided by a six-foot median strip, except at the channelized intersections where the divisional area is widened by moving the traffic lanes out on one or both sides.

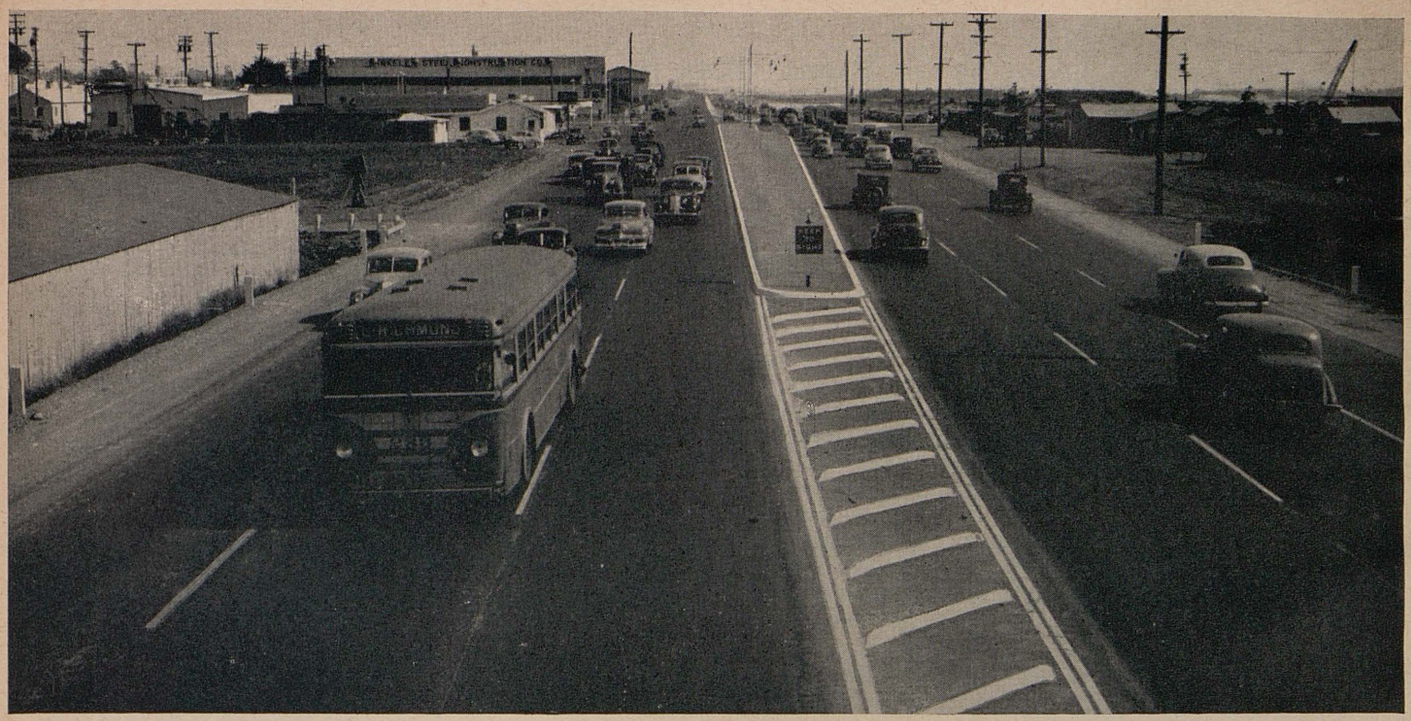
This view of Gilman Street, looking north toward Richmond, with Albany overhead in distance, shows channelization with left turn lanes flaring to widen center strip

With the adequate channelization design the most advanced method of signal control was installed. The full traffic actuated system similar to that used at the other improved intersections on the Eastshore provides a traffic movement with the same car-second delay on both the highway and the cross street.

The heavy left turn movement, required a separate phase and the signal system provides three phases; a green period for traffic on the Eastshore, one for traffic crossing or turning on Gilman Street, and one for the left turn movement off the state highway. In addition the large pedestrian movement across the highway during change of shifts and the width of the highway necessitated pedestrian push buttons to provide a longer green interval for this type of cross traffic.

The type of traffic at this intersection also influenced the need for illumination of this area and six 10,000 lumen units to silhouette both the left turning vehicles and those passing the intersection and at the same time form a transition of brightness for vehicles leaving the intersection were installed.

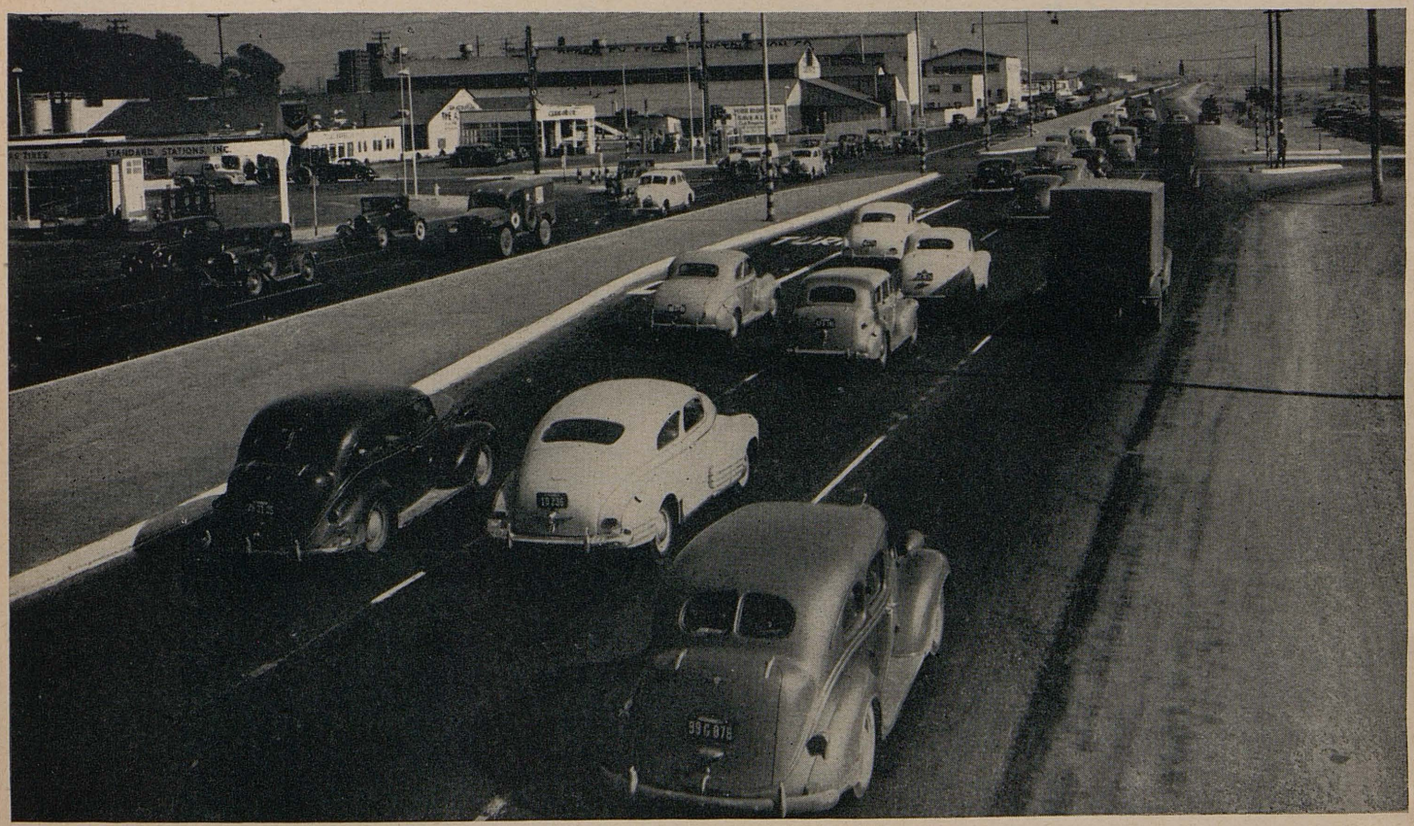
This improvement proves that with an adequate traffic study based on facts, and a project designed and con-



Looking south on Gilman Street toward Bay Bridge. This picture shows flare on right lanes, raised bar division strip on each side of curbed islands, and widening of center divisional island to provide indentures for left-turn lane

structed on these facts, the results will be advantageous. With a traffic volume in twenty-four hours of 45,000 vehicles, a study of the accidents at University Avenue provides the results that may be expected at Gilman Street. A before and after study shows that accidents at this intersection have been reduced from 32 to 12 per year.

View of intersection on Gilman Street, showing left-turn lane and channelizing islands. Traffic lights look south toward Bay Bridge



In Memoriam

Earle David Davis

On the Honor Roll of employees of the Division of Highways who took military leave to serve with the armed forces there is a gold star after the name of Lt. Earle David Davis, Associate Highway Traffic Engineer, District VII, Division of Highways. Lt. Davis was killed in Normandy while serving with the Civil Engineers Corps, U. S. Navy.

Lt. Davis was born in Lead, S. D. on September 12, 1902. He came to work for the Division of Highways on October 17, 1922, and was continuously employed by the department until he went on military leave except for a period in 1924-25 when he returned to college and a period in 1926-27 when he was employed by Riverside County and the City of Riverside. On May 1, 1940, he was promoted to the position of Associate Highway Traffic Engineer.

On May 10, 1943, he was commissioned a Lieutenant in the Civil Engineers Corps, U. S. Naval Reserve, and reported to Camp Peary, Virginia, where he was assigned to duty with the Naval Construction Battalions.

He is survived by his wife, Thelma Elizabeth Davis, his son, Earle David Davis, Jr., and his daughter, Thelma A. Davis.

Deputy State Engineer To Enter Private Practice

HAROLD CONKLING, Deputy State Engineer, Division of Water Resources, has submitted his resignation to enter private practice as a consulting engineer in Los Angeles.

Mr. Conkling has been with the State Division of Water Resources and its predecessors for the past 24 years. He has been in charge of the administration of the water rights code of California since 1927 and in recent years has directed underground water investigations and water right determination in Raymond Basin and other areas in Southern California. He is well known through the Western States where irrigation is practiced as an authority on groundwater hydrology and water supply investigations.

In 1938 Mr. Conkling spent three months in South America as consulting engineer for the Government of Peru in connection with plans for water development and the formulation of water law for that country.

In Memoriam

Chester L. Caine

District VIII of the State Division of Highways is mourning the death of Chester L. Caine, who passed away at the age of 60 years.

Mr. Caine was one of the pioneer employees of the State Highway System, joining the organization in 1912 as a member of a survey crew. Earning steady promotions he transferred to District VIII with Headquarters in San Bernardino in 1929. For the past 15 years he served as Maintenance Superintendent. Mr. Caine made his headquarters in the City of Riverside during the latter part of his service.

His long service made him a member of the "25 YEAR CLUB" composed of State Employees of that length of service. He was a charter member of San Bernardino Chapter No. 7 of the California State Employees' Association.

His industry, faithfulness to his work, and thorough understanding of maintenance practices were the outstanding characteristics of Mr. Caine. He could always be relied upon to be out in stormy weather, day or night, patrolling the highways under his care, to make sure they were safe and passable for the traveling public.

Mr. Caine is survived by his widow, Mrs. Eletta Belle Caine of Riverside.

Progress and Records in Pavement Construction During 1944

(Continued from page 11)

it is necessary to hold the plant temperature to a range of 180 to 200 degrees for the 200 to 300 penetration asphalt, and 225 to 260 degrees for the 150 to 200 penetration.

The elimination of fines in the open graded type results in a mixture that is practically free from the difficulties usually encountered when water is trapped in dense graded surfacing during construction.

The open graded surface generally has better riding qualities than the dense graded surfacing since the spreading machines seem to work more efficiently with this type of mix. The surface texture of an open graded mix is ideal for uniformity; however, it is highly permeable and is not suitable where water-proofing of the road foundation is essential. The cost of the open graded mixture is greater than the dense grading, due to the elimination of the finer sizes which are usually of natural, unprocessed material. It is believed that the saving in maintenance costs, in a great many areas where native fines are not too favorable, will more than offset the increased initial cost.

Road-Mix

The road-mixed method of construction was used on about 23 per cent of the bituminous treated mileage laid in 1944. Of this mileage, only about 8 per cent was mixed with blade graders, the bulk of work being constructed with mixing machines. Some of these mixers were set up at the source of material and used much as a mixing plant, except that the aggregate was not put through a dryer.

Armor Coat

The principal objection to armor coat surfacing is that the present method of construction requires ideal weather conditions. Should the weather become unfavorable during construction, full penetration of the dense course of screenings becomes impossible, and subsequent failures appear in the finished surface.

A method of procedure was worked out by construction personnel in District I, on a nine-mile project in Humboldt County between Trinidad and Little Red Hen, in which multiple courses were successfully constructed. This insures full penetration at air temperatures impossible under former methods, and has resulted in a smoother riding pavement. This procedure was described in the November-December, 1944, issue of California Highways and Public Works, and is being adopted as standard for future armor coat construction.

RECORDS, BITUMINOUS TREATED SURFACES

The record for **surface smoothness** on the 74 plant-mixed projects, involving about 400 miles of road surface, was made on Contract 3WCl, III-Yub.-Sut.-3, 87, Var., 4 sections on Routes 3 and 87, where the roughness index averaged but 7.4 inches per mile. Lester L. Rice was the contractor, with F. D. Hillebrand, resident engineer.

(Continued on page 28)

CALIFORNIA MISSIONS

(Continued from page 19)

President Abraham Lincoln had returned to the Catholic church a number of the Franciscan missions and on January 24, 1874, President Ulysses S. Grant gave back to the church all that remained of Purisima Concepcion.

Deserted by its devoted priests and the Indian neophytes, the mission rapidly decayed and in 1882, Mrs. Helen Hunt Jackson, United States Indian Inspector, describing the California missions, wrote: "The most desolate ruin of all is that of La Purisima Concepcion Mission. Nothing is left there but one long, low adobe building, with a few arches of the corridor; the door stands wide open, the roof is falling in; it has been so often used as a stable and sheepfold, that even the grasses are killed around it. * * * Many of the trees are gone, and those that remain stretch out gaunt and shriveled boughs, which, though still bearing fruit, look like arms tossing in vain reproach and entreaty."

Twenty-three years later, George Wharton James, in 1905, wrote "Everything at Purisima Concepcion now is in sad ruin."

Fr. Engelhardt says that after the spoilation and abandonment of the mission, the whole valley became a sort of wilderness, even the Indian rancherias gradually disappeared.

In October, 1874, the country surrounding the old mission was divided into farms and town lots and settlers established what now is the city of Lompoc. A Catholic community grew up around Lompoc largely due to the efforts of Rev. J. B. McNally, who was in charge of the seminary near Mission Santa Ines. In 1910, Fr. John Reynolds took over as resident priest at Lompoc, where a Catholic church had been erected. He was succeeded by Rev. Charles N. Raley in 1912, which was the 125th anniversary of the founding of Mission Purisima, whose ruins stood only three blocks from the church.

And with the coming of Fr. Raley there began a new era for La Purisima Concepcion. He inspired a civic celebration held December 5, 1912, in observance of the mission anniversary and a huge cross was raised on the hillside facing the ruins of the first mission. Bishop Thomas J. Conaty of the diocese of Los Angeles and Monterey attended with many church dignitaries, state and county officials, representatives of the Native Sons and Native Daughters, and himself blessed the cross that now stands at Lompoc and by night is illuminated with electric lights.

Some 10 years before, the Union Oil Company of California had acquired the Mission lands. The officials of the company decided to encourage a movement to start restoration of the mission and in 1905 the old residence building site was deeded to the Landmarks Club with the provision that the club would provide $1,500 for repair work. This sum was not forthcoming and title reverted to the Union Oil Company.

Definite plans for restoration of the mission were laid in November, 1914, at a meeting called by Father Raley, but it was not until 1934 that by deed of gift, titles to the church ruins and the monastery ruins were transferred to the county of Santa Barbara by the Catholic Church and the Union Oil Company, respectively, and the county and State of California jointly purchased additional lands, making a total of 507 acres. This property was then deeded to the Division of State Parks, and was given the name of La Purisima Mission State Historical Monument. The State requested the National Park Service to establish a Civilian Conservation Corps camp at the site and to undertake the restoration of the mission buildings in cooperation with the Division of Parks. On August 2, 1934, rehabilitation work was begun.

RESTORATION UNDERTAKEN

On July 7, 1935, the first adobe brick was laid and construction of the first unit of the monastery, based on painstaking research, was started. The monastery building alone required the molding of 110,000 adobe bricks, 32,000 roof tiles, and 10,000 floor tiles.

Today, La Purisima Concepcion has regained its former outstanding place among California missions.

Mission visitors motoring north from Santa Barbara have the choice of two routes to Purisima Concepcion, one by way of San Marcos Pass, State Route 80, to Buellton and Santa Ines Mission, thence west from Buellton to the Coast Highway, State Route No. 2, and then 16 miles on State Route 149 to Lompoc; and the other by way of the Coast Highway, State Route No. 2, U.S. 101, to Las Cruces and thence northwest 22 miles to Lompoc.

Coming from the north the way is by State Route No. 2 from San Francisco through Santa Maria to Orcutt, thence south seven miles on the Coast Highway to its junction with State Route 56, thence southwest to Lompoc.

Or coming from the north, the mission visitor may motor over the Valley Route, State Route No. 4, to Bakersfield, thence south and west to Taft and Maricopa west on State Route No. 57 to Santa Maria, south through Orcutt to the junction of State Route 56 and the Coast Highway, and then west to Lompoc, situated in the fertile Lompoc valley, known as "The Valley Beautiful."

Any of these routes make a delightful scenic trip. The visitor to Mission Purisima Concepcion also may reach Lompoc from the south or north over the Southern Pacific lines.

Next—Mission San Luis Obispo de Tolosa and Mission San Antonio de Padua.

Former Highway Employee Wins Commendation

FRIENDS of Lt. Keith Kenfield, on military leave from the San Francisco-Oakland Bay Bridge, read with interest an article by Major General A. D. Bruce, commander of the 77th Division, which appeared in a recent issue of a magazine of national circulation.

In the article, General Bruce paid high tribute to Lt. Kenfield and other officers and men of the 77th Division for heroic conduct in the battle of Guam. Lt. Kenfield continued in action after being wounded in the neck by a Jap bullet.

In a tribute to his outfit, General Bruce said, "Several times I have made the statement that I am proud to belong to the 77th Infantry Division. There are many reasons why I am proud—reasons that such men as these provide. Schaefer, Vozza, Miller, Tiernan, Koeberle, Hatch, Reidda, and Kenfield are not professional soldiers. They were just ordinary American citizens who, before this war overtook them, never thought they'd face an enemy on the field of battle. To all of them, Guam offered their first taste of combat, but they took it like veterans. Each man stood fast and did the job he had been trained to do and a little bit more on top of it."

Highway Bids and Contract Awards

April 1945

COLUSA COUNTY—Portions between Yolo County line and Grimes, about 3.8 miles, to be repaired with road-mixed surfacing. District III, Route 88, Section A. Lee J. Immel, Berkeley, $16,606; M. J. Ruddy & Son, Modesto, $19,920; K.R.C. Construction Co., Berkeley, $21,922; W. C. Railing, Redwood City, $22,407; J. P. Breen, Sacramento, $22,754; A. Teichert & Co., Sacramento, $27,908. Contract awarded to R. A. Westbrook, $16,329.

IMPERIAL COUNTY—Between south gate of Seeley Airport and Route 12, about 1.0 mile to be surfaced with road-mixed surfacing, and between Route 187 and Holtville Airport, about 5.4 miles, a bituminous surface treatment to be applied to shoulders. District XI. Dimmitt & Taylor, Los Angeles, $17,494; Basich Bros. Construction Co., Alhambra, $19,487. Contract awarded to Arthur A. Johnson, Laguna Beach, $15,364.

LASSEN AND MODOC COUNTIES—Portions between Horse Lake Road and Lakeview Junction and between Alturas and Stronghold, about 60 miles to be repaired with plant mixed surfacing and seal coat. District II, Routes 73, 28, 210. Harms Bros., Sacramento, $129,070; Contract awarded to A. A. Tieslau & Son, Berkeley, $126,126.

MADERA COUNTY—Between 6.7 miles north of Madera and Merced County line, about 4.8 miles to be repaired with plant-mixed surfacing. District VI, Route 4, Sections B, C. A. Teichert & Co., Sacramento, $43,651; J. E. Haddock, Ltd., Pasadena, $44,793; N. M. Ball Sons, Berkeley, $45,091; Louis Biasotti & Son, Stockton, $46,169; M. J. Ruddy & Son, Modesto, $48,348; A. A. Tieslau & Son, Berkeley, $48,561; J. Henry Harris, Berkeley, $49,971. Contract awarded to W. C. Railing, Redwood City, $42,697.

PLACER COUNTY—Between Auburn and Bear River, portions only, about 3.2 miles, to be repaired with plant-mixed surfacing on existing roadbed and on new crusher run base borders. District III, Route 17, Aub., C. McGillivray Construction Co., Sacramento, $31,157. Contract awarded to R. A. Westbrook, Sacramento, $25,430.

RIVERSIDE COUNTY—Between Desert Center and Black Butte, portions, about 12.7 miles to be repaired with road-mixed surfacing. District XI, Route 64, Sections C, D. Arthur A. Johnson, Laguna Beach, $51,512; Vinnell Co., Alhambra, $54,645; The Tanner Construction Co., Phoenix, $59,425; Dimmitt & Taylor, Los Angeles, $67,375; Guerin Bros., Los Angeles, $76,305; Owl Truck & Construction Co., Compton, $79,785; Basich Bros. Construction Co., Alhambra, $82,509; Matich Bros., Colton, $89,950. Contract awarded to R. R. Hensler, Glendale, $41,965.

TULARE COUNTY—Between Quail Station and 6.5 miles north of Goshen, about 13.5 miles, to be repaired by placing plant-mixed surfacing and applying seal coat thereto. District VI, Route 4, Sections B, E, F. Griffith Company, Los Angeles, $125,066; Union Paving Co., San Francisco, $129,434; W. C. Railing, Redwood City, $136,674; A. Teichert & Co., Sacramento, $139,925; Louis Biasotti & Son, Stockton, $149,015; J. E. Haddock, Ltd., Pasadena, $150,304; M. J. Ruddy & Son, Modesto, $151,554; N. M. Ball Sons, Berkeley, $153,488; Guerin Bros., South San Francisco, $172,367. Contract awarded to Brown, Doko & Baun, Pismo Beach, $118,504.

May 1945

ALAMEDA COUNTY—Between Mission San Jose and Warm Springs, about 2.4 miles to be repaired with crusher run base and plant-mixed surfacing. District IV, Route 5, Section C. Clements & Co., Hayward, $50,913; Lee J. Immel, Berkeley, $51,779; A. J. Raisch, Paving Co., San Jose, $51,893; N. M. Ball Sons, Berkeley, $52,937; Granite Construction Co., Watsonville, $53,329; Fredrickson Bros., Emeryville, $54,049; J. Henry Harris, Berkeley, $54,255; W. C. Railing, Redwood City, $59,075; Louis Biasotti & Son, Stockton, $61,026. Contract awarded to A. S. Jones, Napa, $45,188.

ALAMEDA COUNTY—Between Warm Springs and Centerville, about 6 miles to be repaired with crusher run base on portions and with plant-mixed surfacing on existing roadbed and on new crusher run base. District IV, Route 69, Section A. Clements & Co., Hayward, $107,277; Louis Biasotte & Son, Stockton, $107,846; N. M. Ball Sons, Berkeley, $109,079; Frederickson Bros., Emeryville, $118,000; A. J. Raisch Paving Company, San Jose, $118,065; Lee J. Immel, Berkeley, $118,300; C. M. Syar, Vallejo, $123,351; Granite Construction Co., Watsonville, $125,930; Frederickson & Watson Construction Co., Oakland, $133,738; Chas. L. Harney, San Francisco, $134,679. Contract awarded A. S. Jones, Napa, $105,040.

BUTTE COUNTY—About 2.5 miles east of Jarboe Pass to be repaired by constructing reinforced concrete cribbing and restoring a portion of the roadbed. District II, Route 21, Section C. Kiss Crane Co., San Pablo, $28,126; J. P. Brennan, Redding, $28,456; C. C. Gildersleeve, Willows, $29,316; W. C. Thompson, San Francisco, $51,305. Contract awarded to E. B. Bishop, Orland, $26,261.

CONTRA COSTA COUNTY—Between Brentwood and 4 miles southeasterly, a distance of about 4.2 miles to be repaired with crusher run base and plant-mixed surfacing. District IV, Route 75, Section D. Clements & Co., Hayward, $84,717; Elmer J. Warner, Stockton, $88,609; A. J. Raisch Paving Co., San Jose, $89,543; W. C. Thompson, San Francisco, $89,957; N. M. Ball Sons, Berkeley, $90,807; Louis Biasotti & Son, Stockton, $92,194; Frederickson & Watson Construction Co., Oakland, $93,525; C. M. Syar, Vallejo, $95,587; Lee J. Immel, Berkeley, $99,737. Contract awarded to Frederickson Bros., Emeryville, $84,640.

HUMBOLDT COUNTY—Between Loleta and Patrick's Point, portions only, a net distance of about 7.5 miles, to be repaired by placing plant-mixed surfacing on imported base material and applying seal coat to the plant-mixed surfacing and prime coat on the shoulders. District I, Route 1, Sections G, I, J. N. M. Ball Sons, Berkeley, $179,668. Contract awarded to Mercer, Fraser Company, Eureka, $170,953.

IMPERIAL COUNTY—Between Route 26 north of Calexico and Calipatria, portions only, about 13.4 miles to be repaired with imported base material and road-mixed surfacing. District XI, Route 201, Sections A, B, C, Slu. The Tanner Construction Co., Phoenix, $128,375; Basich Bros. Construction Co., Alhambra, $131,937; Dimmit & Taylor, Los Angeles, $190,715. Contract awarded to Norman I. Fadel, North Hollywood, $115,650.

KERN COUNTY—Between Route 145 near Rademacher and Inyokern-Trona Road, about 8.2 miles to be graded and bituminous surface treatment applied. District IX, Route-Inyokern Ordnance Sta. R. R. Hensler, Glendale, $68,963; Vinnell Company, Alhambra, $71,103. Contract awarded to Arthur A. Johnson, Laguna Beach, $68,532.

LOS ANGELES COUNTY—Between Latigo Canyon and one mile westerly of Malibu Creek, about 3.3 miles to be repaired with plant-mixed surfacing over existing pavement and shoulders and seal coat to be applied to shoulders. District VII, Route 60, Section A. Southwest Paving Co., Roscoe, $44,015; Vido Kovacevich Co., Southgate, $51,525; Oswald Bros., Los Angeles, $56,445. Contract awarded to Schroeder & Co., Roscoe, $43,070.

VENTURA COUNTY—Between the city of Ventura and Ojai, portions only, a net length of about 2.1 miles, to be repaired with plant-mixed material. District VII, Route 138, Section A. Schroeder & Co., Roscoe, $35,410; Frontier Construction Co., Whittier, $35,760; Griffith Co. Los Angeles, $36,684. Contract awarded to Oswald Bros., Los Angeles, $35,400.

Report on Progress and Records in Pavement Construction During 1944

(Continued from page 26)

Eighty-seven per cent of plant-mixed projects were for repairs of existing surfaces. Surface smoothness for the entire State averaged 16.8 inches per mile, compared to 18.8 inches in 1943.

The record for **road-mixed surfaces** was made on Contract 11ASC1, XI-S.D-Access, Camp Lockett to Route 200, where 15.2 inches per mile was averaged by B. G. Carroll, contractor, with R. C. Payne, resident engineer. The average for the State was 32.9 inches per mile, compared to 22.4 inches in 1943.

The record for **armor coat surfaces** was made on Contract 1TC3, I-Hum-I, J, Trinidad to Little Red Hen, where 21.3 inches per mile was averaged by Marshall S. Hanrahan, contractor, with H. M. Hansen, resident engineer. The State average was 48.3 inches, compared to 48.1 inches in 1943.

Ends Long State Service

For 21 years Maintenance Engineer of District VIII, Division of Highways, with headquarters in San Bernardino, Joseph E. Stanton has resigned from State service to enter private business in Los Angeles.

Mr. Stanton's career with the Division of Highways began in the summers of 1913 and 1914 while he was enrolled at the University of California. Following his graduation as an engineer in 1915, Mr. Stanton was employed as an assistant to E. Q. Sullivan, present District Highway Engineer of District VIII, who was then stationed at Corning in District II. When the San Bernardino district was formed 21 years ago with Mr. Sullivan in charge, Mr. Stanton, then a highway superintendent at Big Bear, was selected by Mr. Sullivan as maintenance engineer.

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C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney

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SCALE IN MILES
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~LEGEND~
Primary Routes
Secondary Routes
Proposed Routes

SAN FRANCISCO AND VICINITY

LOS ANGELES AND VICINITY